



# ACTA CHIRURGICA SCANDINAVICA

\*

SUB TITULO

NORDISKT MEDICINSKT ARKIV

CONDIDIT MDCCCLXIX AXEL KEY

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REDACTORES

*R. FALTIN*

Helsingfors

*AAGE NIELSEN*

Aarhus

*J. HOLST*

Oslo

*EINAR KEY*

Stockholm

*S. KJÆRGAARD*

København

*F. LANGENSKIÖLD*

Helsingfors

*G. PETREN*

Lund

*CARL SEMB*

Oslo

*G. THORODDSEN*

Reykjavik

REDIGENDA CURAVIT

*EINAR KEY*

Stockholm

ACCEDENTE

*J. HELLSTRÖM*

Stockholm

COLLABORANT

IN DANIA O Chievitz, Fabricius-Møller, J Foged, J Ipsen, E Dahl-Iversen,  
L Kraft, A Lendorf, N Aage Nielsen, H. Retlev-Abrahamsen, C Wessel

IN FINNIA H Elving, M Hämäläinen, T Kälina, L Lindström, P E A Nylander,  
A J Palmén, V Seiro

IN NORVIGIA N Backer-Grøndahl, A Berg, A Brekke, P Bull, H F H Harbitz, R Inge-  
brigtsen, E Platon, A Sunde

IN SUECIA F Bruer, G Bohmansson, C Crafoord, K H Gieritz, O Hultén, S Johans-  
son, N Liedberg, E Ljunggren, G Nystrom, H Olivecrona, J Palmer,  
E Perman, S Rödén, O Schubert, J P Strömbeck, G Söderlund, A Troell,  
H Waldenström, J Waldenström, A Westerborn, H Wulff J Åkerman

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*Axel Key*

# ACTA CHIRURGICA SCANDINAVICA.

SUB TITULO NORDISKT MEDICINSKT ARKIV  
CONDIDIT 1869

On the initiative of Professor AXEL KEY, the faculty of Karolinska Institutet (The Caroline Institute) published a medical journal "Medicinskt Arkiv" during the years 1863 to 1868. Three volumes of the journal were published. AXEL KEY was one of the three editors.

During this period it became increasingly evident to AXEL KEY that instead a journal representing the whole of Scandinavia should be published, with contributions from all the Nordic countries and with abstracts of all the rest of Nordic medical literature. "Medicinskt Arkiv" was therefore discontinued, and a new medical journal was started in the year 1869 under the name of "Nordiskt Medicinskt Arkiv" with AXEL KEY as the editor-in-chief. A special editorial committee was formed in each of the medical universities in Denmark, Finland, Norway and Sweden. The articles were printed in Danish, Norwegian or Swedish with a summary in French. The journal also contained abstracts of the rest of the Scandinavian medical literature in French.

The journal, which was published in one volume (four numbers) per year, contained publications of scientific interest and value in all the different fields of medicine.

By the end of the 1890's it was obvious that the archives had to be reorganized if the original program of the journal was to be carried out. The medical literature in the Scandinavian countries had increased greatly in volume and "there was no longer room in the journal for as many of the original articles as desired. Medical science had become more and more specialized. An increasing number of specialized journals had been started in other countries. Specialists were naturally more interested in publishing their studies in these foreign journals, for then their work was presented in an international language to the

## PREFACE

audience they wished to reach." On the initiative of AXEL KEY and in collaboration with the editorial committees, it was decided, therefore, to divide up the journal into "Afdelning I Kirurgi" (Section I Surgery) and "Afdelning II Medicin" (Section II Medicine). It was also decided to print the journal as much as possible in international languages. Experience had shown that the Nordic medical literature had not received enough attention in other parts of the world, and consequently that numerous Nordic research workers preferred to publish their investigations in a foreign language in foreign journals, with the result that their Nordic nationality passed unnoticed. It was also desired to make the archives more accessible to foreign readers. Consequently, it was determined to print as many as possible of the original articles in English, French or German and to have any original articles in Scandinavian languages followed by a summary in English, French or German. The abstracts were to be printed in German.

"Nordiskt Medicinskt Arkiv Afdelning I Kirurgi" covered surgery, ophthalmiatrics, ear, nose and throat diseases, obstetrics and gynecology, and studies in pathology and bacteriology connected with these subjects. "Nordiskt Medicinskt Arkiv Afdelning II Inre Medicin" covered internal medicine, nervous diseases, psychiatry, pediatrics, venereal and skin diseases, general pathology and histology with bacteriology, pharmacology and toxicology, legal and state medicine, hygiene, balneology and so on. Each section was issued in one volume of six numbers every year. Each section had an editor in each one of the Scandinavian countries.

This important reorganization of the journal was planned and executed by AXEL KEY in 1900, despite a severe and particularly painful disease which greatly reduced his strength. It went into force in the year 1901 with volume 34. That year AXEL KEY resigned as editor-in-chief of Nordiskt Medicinskt Arkiv. His successor was Professor C. G. SANTESSON, who had aided him with the reorganization.

AXEL KEY died on December 27, 1901 after having been editor-in-chief of the archives for thirty-two years. AXEL KEY shouldered the financial responsibility for the archives himself and it cost him large personal losses. From 1901 on the financial management was taken over by a guaranty company formed of Swedish physicians.

The editors for the surgical section were O BLOCK (Copenhagen), ALI KROGIUS (Helsingfors), JOHAN NICOLAYSEN (Christiana) and JOHN BERG (Stockholm) who was also editor-in-chief. BLOCK was an editor until 1904, when he was followed by E SCHMIEGELOV who had the post from 1904 to 1915. In 1916 SCHMIEGELOV was succeeded by V SCHALDEMOSE. J BERG retired as chief editor at the end of 1912 and was followed by E KEY.

After volume 42, published in 1909, no more abstracts were published in the surgical section of the archives.

It gradually became clear that the idea of giving a complete picture of all that was done in Nordic medicine had to be abandoned. In 1919 it was decided to change the two sections of the archives, the surgical and the medical, into two independent scientific journals with a more limited scope. Since it was assumed that journals with a Swedish name would not be read as much in foreign countries and that a name in one of the international languages would be disadvantageous in countries with another language during the tension then existing after the first world war, the historical name "Nordiskt Medicinskt Arkiv" was retained on the title page, but "Afdelning I Kirurgi" was changed to *Acta Chirurgica Scandinavica* and "Afdelning II Inre Medicin" to *Acta Medica Scandinavica*. *Acta Mathematica* had already been given out in Sweden and *Acta Oto-laryngologica* had recently been started. It was planned to issue other medical journals from the Scandinavian countries under the name of *Acta*. Thus AXEL KEY's hope that "Nordiskt Medicinskt Arkiv" would give birth to a number of specialized medical journals was realized.

The original number sequence of the volumes was continued to show that *Acta Chirurgica Scandinavica* and *Acta Medica Scandinavica* were direct continuations of *Nordiskt Medicinskt Arkiv*. *Acta Chirurgica Scandinavica* was started in 1919 with volume 52.

Like its predecessor, "Nordiskt Medicinskt Arkiv Afdelning I Kirurgi", each volume of *Acta Chirurgica Scandinavica* consists of six numbers. Each number consists of about six printed sheets. In order to get the articles published more quickly, the numbers are issued as soon as they can be printed. During later years generally more than one volume have been published per year, sometimes up to two a year. The articles are written in English, French or German and each article is followed by summaries in English, French and German. The length of the papers

printed in the journal has gradually been restricted. In order that longer papers might be published and distributed along with *Acta Chirurgica Scandinavica* and spread with the journal, beginning with volume 55 of 1922, theses have been published as supplements and sent to subscribers and the journals with which exchanges are made. Since 1919 forty-one volumes of *Acta Chirurgica Scandinavica* and eighty-nine supplements have been given out.

The editorial board consists of two editors in each of the Scandinavian countries.

The editors from and including volume 52 were V. SCHALDEMOSE (Copenhagen), A. KROGIUS and R. FALTIN (Helsingfors), J. NICOLAYSEN and P. BULL (Oslo) and J. BORELIUS (Lund) and EINAR KEY, editor-in-chief (Stockholm). P. N. HANSEN (Copenhagen) became a member of the editorial staff with volume 53. After BORFLIUS' death in 1921, GUSTAF PETRÉN (Lund) became an editor, after SCHALDEMOSE's death in 1916, S. KJAERGAARD and after A. KROGIUS' death in 1939, F. LANGENSKIÖLD. Because of advancing age J. NICOLAYSEN retired from the staff in 1942, P. BULL in 1941 and P. N. HANSEN in 1943. These editors were succeeded by JOHAN HOLST (Oslo), C. SEMB (Oslo) and AAGE NIELSEN (Aarhus). G. THORODDSEN (Reykjavik) joined the editorial staff in 1938.

Nordiskt Medicinskt Arkiv's guaranty company was reorganized in 1919 as "Foreningen for utgifvande af *Acta Chirurgica Scandinavica* och *Acta Medica Scandinavica*" (Society for publication of *Acta Chirurgica Scandinavica* and *Acta Medica Scandinavica*). At the end of 1935 this society was dissolved and two new societies were formed "Foreningen for utgifvande af *Acta Chirurgica Scandinavica*" and "Foreningen for utgifvande af *Acta Medica Scandinavica*", whereupon *Acta Chirurgica Scandinavica* and *Acta Medica Scandinavica* became completely divorced. *Acta Chirurgica Scandinavica* is owned and published by "Foreningen for utgifvande af *Acta Chirurgica Scandinavica*", which is an association of Swedish surgeons.

*Acta Chirurgica Scandinavica* is thus a direct continuation of Nordiskt Medicinskt Arkiv, which was first published in 1869. Consequently this year, 1944, the journal celebrates its seventy-fifth anniversary. Furthermore, twenty-five years have passed since the foundation of *Acta Chirurgica*. It is to celebrate these occasions that this jubilee number is being published.

July 1944

*Einar Key*

# Lumbago and Intervertebral Disk Herniation.

By

HENNING WALDENSTROM

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Lumbago may be characterized as a painful contraction of sudden onset in the lumbar spine. The Swedish term, 'lyggskott', which literally translated means "shot in the back", aptly expresses the violent nature of the complaint.

At best, lumbago passes over quickly never to return, but it often has a tendency to remain in a subdued form or to recur. In the former case the condition is known as chronic lumbago, in the latter as recurrent lumbago.

The causes of lumbago are manifold and are to be found in various diseases. One disease that often begins with lumbago is sciatica. It frequently happens that sciatica is caused by intervertebral disk herniation, and the onset of this form of sciatica is generally characterized by low-back pain. Sciatica caused by intervertebral disk herniation can often be cured by extirpation of the hernia, after which the lumbago also disappears. It is this form of lumbago that I shall discuss in the following in an attempt to explain why it is combined with sciatica and why the lumbago usually appears first, sometimes long before the signs of sciatica.

The course of the lumbago-sciatica disease is often as follows. First the patient has an attack of lumbago without any signs of sciatica. Thereafter the low-back pain may disappear completely, then return again to become chronic lumbago, eventually combined with sciatica. This symptom complex is customarily known as lumbosciatica. It is primarily characterized by pain and pressure tenderness in the lumbar spine and the lower extremity, while clinical examination discloses contraction in the muscles of the lumbar spine — the sacrospinalis, combined with a contraction in the long extensors of the hip — the semimembranosus, semi-

tendinosus, and biceps muscles. These muscles, like the lower portion of the sacrospinalis, receive their nerve supply from the fourth lumbar to the first sacral nerve root. The contraction in the hip is known as the Lasègue sign and constitutes the first and, therefore, the most important objective sign in the diagnosis of incipient sciatica.

The cause of the Lasègue sign may be explained as follows. When the leg is flexed in the hip joint with the knee in extension, the sciatic nerve is tensed. This tension reaches to the dural sheath of the nerve roots. If the fourth and fifth lumbar vertebral arches are removed, extension of these nerve roots will be observed in connection with the Lasègue test. In sciatica, one of these nerve roots is sensitive to pressure and extension. The contraction in the aforementioned muscles perhaps occurs in order to prevent a painful tensing of the sensitive nerve root. Likewise, it is conceivable that in lumbago the contraction in the lower portion of the sacrospinalis prevents a painful movement in the vertebrae between which runs an irritated nerve root.

Two cases which I have observed illustrate two kinds of lumbago in which sciatica appeared later.

*Case 1* A 36-year-old labourer was about to lift a heavy object from the ground. As he bent forward he suddenly felt violent pain in the lumbar spine as if he had been stabbed with a knife or his spine had snapped in two. He had to be carried home. He gradually recovered and went back to work. Eight months later, severe pain, accompanied by neurologic signs of sciatica, suddenly developed in the patient's left leg. A large intervertebral hernia was extirpated, and the patient recovered from his lumbago and sciatica.

*Case 2* A 33-year-old man, who had had one or two mild attacks of lumbago during the preceding four years, was lifting a ten-kilogram case when he felt his back stiffen. When I examined him on February 5, 1943, the lumbar spine was completely fixed and the Lasègue sign was absent. Reflexes and sensibility were normal. On February 22, when the patient bent down to pick up a pencil from the floor, he suddenly experienced such violent pain in the back that he fell down and was unable to move for several hours. Examination the next day showed the lumbar spine fixed in kyphosis. The inferior part of the sacrospinalis muscle was highly tender to palpation. On April 4 pain began to be felt in the right calf. At that time the Lasègue sign was present at 80 degrees. The reflexes and sensibility were normal. On April 22 the pain became so severe that the patient was unable to sleep. Numbness in the right foot and calf also developed during the same night. Examination the following day revealed the Lasègue sign to be present at 60 degrees, as well as

decreased sensibility on the outer aspect of the right foot. The reflexes were normal. On April 29 a more than pea-sized hernia between the fourth and fifth vertebrae was extirpated, the nerve root was found to lie firmly fixed over the hernia. The operation relieved the patient not only of sciatica but also of lumbago.

It is not unusual for lumbago to make its appearance in the explosive manner described in these two cases. In Swedish this sudden form of lumbago is usually known as "witch's shot". This term not only expresses the sudden character of the pain — like a shot — but also the mysterious, not to say magic way in which a strong man's spine, for no apparent reason, will suddenly lock so that he is unable to move. In one of the cases this occurred when the subject in the course of his ordinary work was about to lift a heavy object, in the other when the subject bent over to pick up a pencil from the floor.

The pain in both cases was of the same intense, paralyzing character, despite the fact that the efforts involved in the movements were so dissimilar. The belief is often expressed that lightning-like pains of this sort are the result of compression of a nerve. The lumbago which precedes sciatica frequently makes this kind of sudden debut. In lumbago-sciatica caused by intervertebral disk herniation a nerve, or at least a nerve root has really been squeezed. May it not be that sudden, intense lumbago that never turns into sciatica also results from intervertebral disk herniation? This theory is further supported by the way in which not only sciatica, but also lumbago disappears following the removal of a disk hernia.

Perhaps along these lines we can find an explanation of some of the sudden recurrent lumbago without sciatica which has been given so many different names: muscular rheumatism, or, if preceded by a quick movement, rupture of the sacrospinalis, distortion of the vertebral column, etc.

I consider it probable that recurrent lumbago which is never combined with sciatica may also be caused by intervertebral disk herniation.

The fact that these cases of lumbago are sometimes relieved by rest, corrective therapy, jacket treatment, etc., does not disprove my contention, since most cases of sciatica caused by a disk hernia undoubtedly can also be cured, at least temporarily, with such treatment.

Thus, lumbago may appear due to pressure on a nerve root, and



this form of lumbago may recur several times without any signs of sciatica

The explanation of the fact that an isolated attack of lumbago often introduces the lumbago-sciatica complex can be sought in the following circumstance. Nerve fibers pass through one and the same nerve root not only to the part of the spinal musculature in which the lumbago has its site, but also to that part of the lower extremity where the signs of sciatica make their appearance. It is therefore possible that the nerve fibers in the nerve root which pass to the lumbar spine are affected before those which pass to the legs.

The interesting investigations made by SVEN INGVAR on herpes zoster<sup>1</sup> and by ARGYLL ROBERTSON on tabes<sup>2</sup> have clarified important points with regard to the position of the nerve fibers in the nerve root. For instance, these studies make it appear probable that the sensitive fibers which innervate the muscle of the lumbar spine lie in the periphery of the nerve root.

According to INGVAR, the spread of herpes zoster is due to the outer fibers coming into contact with some irritant from the cerebrospinal fluid. In the case of lumbo-sciatica, a more mechanical factor must be involved, usually a disk herniation. The chain of events may be imagined to be as follows. First the disk hernia is small with no intimate contact with the nerve root except in connection with movements, in which traction is exerted on the sciatic nerve, for example, when the subject bends over with straight knees to pick up something from the floor. Traction of this kind is continued, as mentioned above in connection with the Lasègue sign, to the lowermost nerve roots in the lumbar spine. In these bending and rotating movements, so common in daily life, the hernia presses on the nerve root, if only briefly, or as long as the extreme movement lasts. The root glides, so to speak, over the hernia in certain movements. The outer fibers are irritated in this way and react with pain and pressure tenderness in the area served by them, i. e. in the deep muscles in the lumbar spine.

As a rule, more and more nuclear tissue is expressed as time goes by, so that the hernia gradually increases in size. The pressure on the nerve root increases proportionately with the growth of the hernia, and in consequence the fibers which lie deeper in the nerve root, those which pass down the leg, also become involved, after which sciatica associates with the lumbago.

<sup>1</sup> Acta med scand Bd 65 1927

<sup>2</sup> Acta ophthalm Bd 4, 1928

A mechanical irritant of sudden appearance and equally sudden disappearance can be explained in still another way. It was recently discovered by FOLKE KNUTSSON,<sup>1</sup> in a study on patients at the orthopaedic clinic at the Vanforeanstalt with spinal complaints such as insufficiency, lumbago, etc., but with a normal roentgen picture, that the vertebrae in the lumbar spine are not always, as previously believed, firmly attached to one another by an intervertebral disk. Instead, his roentgen studies showed that in pronounced flexion of the body, particularly forward flexion, a displacement of the lumbar vertebrae occurs in certain of these cases of spinal complaint, indicating that the intervertebral disks are abnormally flexible.

It may well be that lumbago can develop in connection with deep forward flexion in which a nerve root is suddenly compressed between two vertebrae due to the narrowing of the intervertebral foramen consequent on the movement of flexion. If, in addition, a disk herniation is situated in the foramen, an extreme movement would lead to even greater compression of the nerve root.

TORBEN ANDERSEN gives another explanation of the low-back pain initiating the sciatica. The lumbago-ischias according to his view consists of two parts, first rupture of the annulus fibrosus followed by lumbago, then protrusion of the intervertebral disk causing sciatica through compression of a nerve root. The explanations of ANDERSEN and myself are only reflections on the origin of the lumbago by ischias — perhaps none of them is the right one.

### Summary.

The appearance of sciatica is so often heralded by an attack of lumbago that we call the disease the lumbo-sciatica complex. If this condition is due to an intervertebral disk herniation, extirpation of the hernia cures the patient, not only of his sciatica but also of his lumbago. Hence the latter condition, too, must be due to the disk herniation.

In answer to the question why the lumbago always appears first, it is pointed out that the nerve fibers to the spinal muscles lie in the periphery of the nerve root and are therefore irritated first. Later on, due to the action of the intervertebral disk herniation, the deeper fibers, too, become irritated, whereupon signs

<sup>1</sup> Acta radiologica, 1944

of sciatica also develop It does not appear improbable that certain cases of recurrent lumbago without sciatica also are due to intervertebral disk herniation

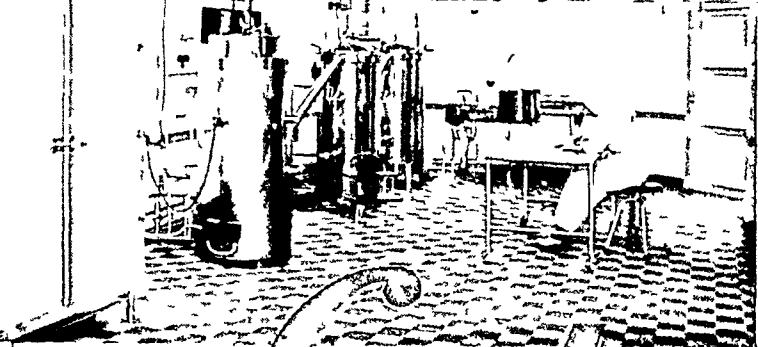
### Zusammenfassung.

Es kommt so häufig vor, dass eine Ischias mit einem »Hexenschuss« beginnt, dass wir diese Krankheit Lumbo-Ischiaskomplex zu nennen pflegen Wenn die Krankheit durch einen Zwischenwirbelscheibenprolaps bedingt ist, so wird der Kranke durch die Exstirpation desselben nicht nur von seiner Ischias sondern auch von dem Hexenschuss befreit Letzterer muss dann auch durch den Zwischenwirbelscheibenprolaps verursacht gewesen sein Die Frage, warum der Hexenschuss immer zuerst auftritt, lässt sich dahin beantworten, dass die sensiblen Nervenfasern für die Rückenmuskulatur peripher in der Nervenwurzel gelagert sind und deshalb zuerst gereizt werden Bei längerem Einwirken des Zwischenwirbelscheibenprolapses werden auch die tiefer gelegenen Fasern gereizt, wobei auch Ischiassymptome auftreten Er durfte nicht unwahrscheinlich sein, dass gewisse rezidivierende Hexenschüsse ohne Ischias gleichfalls durch einen Zwischenwirbelscheibenprolaps bedingt sein können

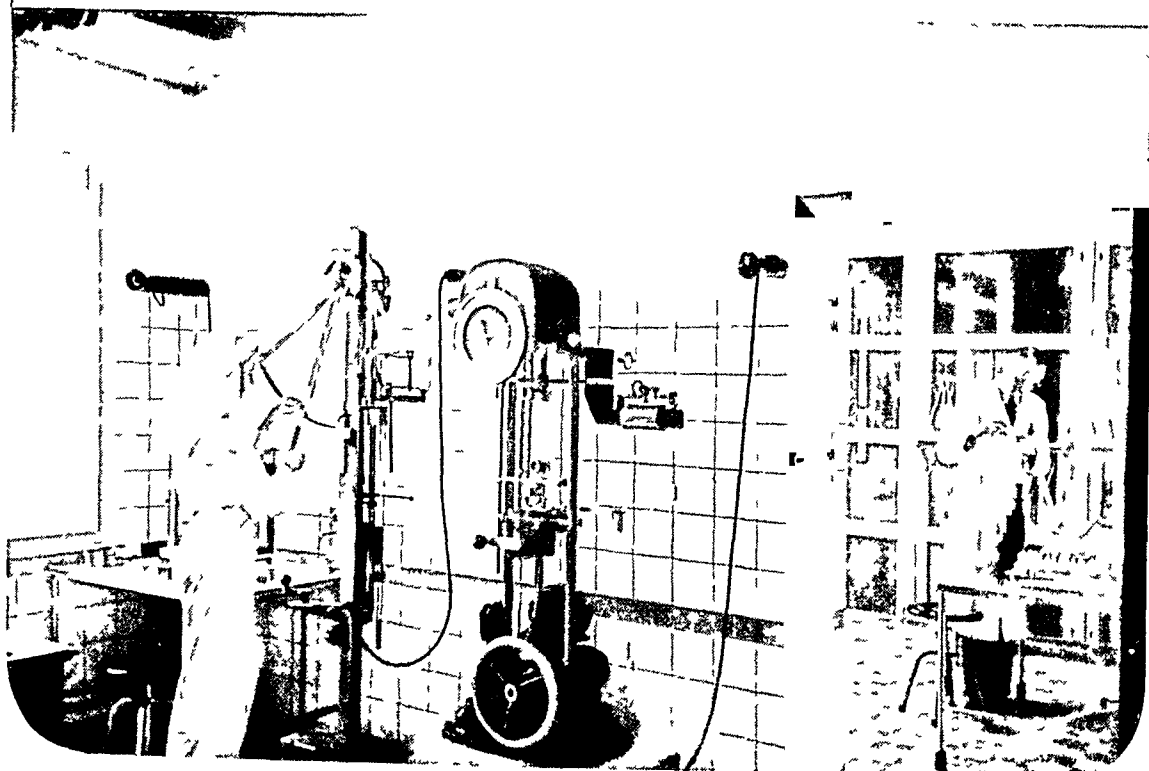
### Résumé.

Il est si habituel que la sciatique débute par un lumbago que nous avons coutume d'appeler cette affection le syndrome lumbosciatique Lorsque la maladie est due au prolapsus d'un disque son extirpation débarrasse le patient non seulement de sa sciatique mais encore de son lumbago Ce dernier doit donc être également causé par le prolapsus discal A la question de savoir pourquoi le lumbago précède toujours la sciatique on peut répondre que les filets nerveux sensitifs qui vont aux muscles du dos occupent la périphérie des racines nerveuses et sont donc irrités les premiers Lorsque l'action du prolapsus se prolonge les filets situés plus profondément sont irrités à leur tour, ce qui fait apparaître les symptômes de sciatique aussi Il n'est pas défendu de croire que certains lumbagos récidivants non accompagnés de sciatique puissent également dépendre d'un prolapsus du disque

ASTRA



*Carlqvist* -  
SVENSK TILLVERKNING





## Filling of Sterile and Infected Bone Cavities by Means of Plaster of Paris.

By

AAGE NIELSEN

Various attempts have been made to diminish or eliminate the difficulties in closing up large bone cavities after operations for bone cysts, benign bone tumours, tuberculosis, bone abscesses, cavities left after osteomyelitis, etc

*In case of sterile cavities* the soft parts may be closed primarily, it depends on the size of the cavity and the thickness of the soft tissue above the cavity whether formation of fistulas with ensuing infection is avoided or not. Cases with small cavities and rather abundant supply of soft tissue will often succeed

In some cases — especially in diaphysial cavities in the long bones — the cavity may be reduced by chiselling off its edges, the disadvantages of this method are that it cannot be applied to large cavities without impairing the strength of the bone, and that it has but a very limited applicability in the vicinity of joints and in most small bones

In other cases the cavity may be filled up with pedicelled soft tissues such as muscular tissue, subcutis, subcutis + skin, if its form, size, and place are favourable, but very often this is not the case, and the cosmetic result will, if subcutis + skin are used, be compromised by the indrawn scar

Free transplantation of fat-tissue may be excellent, especially in small cavities, if the cavity is sterile, and this method has been widely used. The disadvantages are that it may be difficult to obtain fat-tissue to large cavities, that sometimes it necroses and forms fistulas, and finally that the successful fat-filling, where the fat will live on as a fibrous plug, does not possess osteogenetic properties, but remains as a fibro-lipomatous space in the bone,

surrounded by a sclerosed bone capsule. In small cavities this is of no importance, but in large ones it may mean a permanent impairment of the strength of the bone.

*If the cavity is infected*, living transplant cannot be used. Filling with dead substance has been tried with a great variety of substances, especially about the turn of century a great number of suggestions appeared, blood-clot, decalcified bone tissue, sponge, catgut, plaster of Paris, cement, gutta-percha, copper amalgam, and Mosetig-Moorhof's filling consisting of iodoform, spermaceti, and oil of sesame. In 1926 OEHLECKER reported 6 closures with plaster, in 1927 NYSTROM recorded closure with rivanol-plaster in 4 cases, and EDBERG in 3 cases in 1930.

Although thus numerous suggestions for closure with dead substance have been made, I am under the impression that the method has not been employed very much, and the literature on the subject is on the whole scarce.

During the last 10 years or so we have in 30 cases employed plaster for filling in bone cavities. In 14 cases the cavity was sterile beforehand, in 2 cases it was infected with tuberculosis, and in 14 cases with unspecific microbes.

In the 14 cavities sterile beforehand the diseases involved were

Cyst in superior maxillary (size as a walnut or larger)	4 cases
Giant-cell tumour in sup. maxill. (as a walnut)	1 "
Cystis mandibulæ ( $1\frac{1}{2}$ — $1\frac{1}{2}$ the size of a walnut)	2 "
Ostitis fibrosa humeri ( $2\frac{1}{2} \times 2\frac{1}{2}$ cm)	1 "
Cystis ulnæ ( $1\frac{1}{2}$ the size of a date)	1 "
Cystis ulnæ ( $3 \times 2$ cm)	1 "
Resect. capit. oss. capitati ( $\frac{3}{4} \times \frac{3}{4}$ cm)	1 "
Cystis metacarpi (twice the size of an almond)	1 "
Chondroma falangis I digiti III ( $\frac{3}{4} \times 2$ cm)	1 "
Cystis femoris ( $4 \times 4$ cm)	1 "
<hr/>	
Total	14 cases

The method of the closure is as follows. The bone cavity is exposed and cleaned so that only sound bone tissue remains, if it is rough, it may be necessary by means of curette or chisel to clean sinuosities. Only if the bone wall is scraped clean all over of possible cyst membrane, granulations, tumourous tissue, etc., a good lasting result may be expected. If there is haemorrhage from the wall, tamponade is used for a few minutes, until it is arrested.

or negligible. Then a firm gauze tampon is plugged in while the filling is prepared.

The plaster is ordinary good plaster of Paris without addition of antiseptics. Such antiseptics (e. g. iivanol, phenol, methylviolet) will give a protracted process of hardening, which is a drawback, this applies to an even higher degree if it is polluted by blood or tissue fluid, for which reason it is of importance that the field is "dry" in the moment the filling is applied.

In a number of cases we inoculated ordinary plaster from the plaster tin on beef extract, but had never growth. Presumably sterilization is unnecessary, but for the sake of security we have for the fillings exclusively used plaster which has been dry-sterilized at  $140^{\circ}$ — $150^{\circ}$  for  $\frac{1}{2}$  hour in small boiling flasks. Heating for a longer period and particularly to a higher temperature will make the plaster less apt to harden even though it is not "dead-burnt" until at  $190^{\circ}$ . We have always a few small flasks with such plaster stored away in a dry place closed with cotton plugs and tied down with paper. Under such conditions the plaster is fit for use for at least a year, presumably more.

The plaster is mixed up in a sterile cup with sterile water to a thick paste. This paste should, if possible, be placed in the bone cavity in such a way that the soft parts are not polluted by the plaster, since it is difficult to remove completely, and besides it may impede the primary adhesion of the sutured soft parts. Accordingly, the plaster is introduced into the cavity by means of a syringe. The ordinary syringes with close-fitting metal piston are unpractical because the plaster will block the piston. We use the old-fashioned gonorrhoea glass-syringes with thread-packed piston. With Kocher's spoon the paste is poured into the syringe, the piston is moistened to ensure easy working, and the paste is pressed into the nozzle of the syringe. While the soft parts are retracted, the nozzle is introduced towards the bottom of the cavity, and with his hand covered by gauze the operator depresses the piston until the cavity is filled with plaster almost to the edge. Then the injected plaster is compressed with a gauze tampon very firmly against the bottom of the cavity and into the sinuosities, after that more plaster is filled into the cavity, and the compression is repeated and so on until the firmly compressed filling is in level with the surface of the bone, now we must wait a few minutes until the plaster is half-hardened, while, as far as possible, it is protected from exuding blood or tissue fluid. The surface of the plaster may then be smoothed with a knife or curette. Suture of the soft parts in layers.

If the field is sterile, the adjacent bone tissue will organize with the filling. This will, however, not always occur without reactions. In the days following the operation there may be pain, swelling,



and rise of temperature — also in case of sterile field. In most cases, especially in cases of fillings in the extremities, such reactions do not appear or are insignificant, but in case of large fillings in the facial bones, particularly the superior maxillary (Fig 3), they may be more conspicuous, so that after large fillings in the superior maxillary there may be pain, edema, and rise of temperature up to a maximum of  $39^{\circ}$  for some days, and then it all settles down.

If the filling is placed superficially, e. g. in the superior or inferior maxillary through an incision in the mouth, a slight amount of secretion is often discharged, which may involve formation of fistulas reaching the surface of the plaster, which may be felt by a probe or be seen. This is of no or very slight importance to the later course. The surface of the plaster may crumble a little, so that small plaster particles are discharged, but otherwise the course will be as at primary healing.

Shortly after the operation — presumably already in the course of 1 or 2 weeks — an ingrowth of granulation tissue into the plaster will commence from the surface of the bone cavity, whereby the plaster is resorbed concentrically. Thus an intimate connection between the plaster and bone tissue is formed, so that the fillings becomes firmly attached to the cavity. *When this connection has been established, the cavity will not be infected, even though there may be an opening of varying size down to the surface of the plaster.* The concentric resorption of the plaster may be observed on x-ray photographs, it is a comparatively rapid process, e. g. fillings of a size as a hazel-nut will generally be completely resorbed after a period of 6—8 weeks, of the size of a walnut after the lapse of about 2—4 months (Fig 2), of the size of a hen's egg after about 6 months. When once the filling has become firmly attached to the cavity of the bone, the purpose of the operation will in the main be achieved, while the plaster is being resorbed, the cavity will be filled up with granulation tissue, which will gradually reach the surface of the bone and join the adjacent soft tissue. In the cases where there has been a fistula to the surface of the plaster, the fistula will then close. The drawbacks of such fistulas are on the whole inconsiderable. As far as the mouth is concerned, they only amount to a slight taste of plaster in the mouth, but patients having tried either method state that this discomfort cannot be compared to the drawbacks of the tamponade.

In contradistinction to the fat-fillings the granulation tissue coming from the bone *is capable of forming bone tissue*. In children and with small fillings the x-ray photographs show an incipient ossification after the lapse of approximately 2 months, in adults and with larger fillings after some months. Varying according to the size of the filling and the age of the patient, it may last from 3 months to several years before the cavity becomes completely ossified. The localization is possibly of importance, cavities in the mandible (size approx as a walnut) may be fully ossified in the course of  $1\frac{1}{2}$ —2 years (Fig 2). In a 55-year-old diabetic a cavity in femur (size  $\frac{2}{3}$  of a hen's egg) was only half ossified after 4 years. Provided that the original pathological process has not impaired the strength of the bone, the patient will, however, be cured and capable to work from the time when the primary reaction of the filling has disappeared.

In the 2 cases of cavities infected with tuberculosis the diseases involved were

Collum femoris focus with sequestrum	1 case
Tuberculosis cuboides	1 "

To achieve a favourable result of filling in case of tuberculosis it is necessary that the tuberculosis is clearly limited, so that the cavity may be scraped clean. In progressing processes the limit between affected and unaffected tissue is difficult to ascertain, so that either too little or too much is removed, and it is on the whole difficult, if not impossible, to sterilize infected spongy tissue. But in well limited tuberculous processes plaster filling may be employed successfully. In other respects the method and course are as in the infected cavities.

In the 14 cases where the cavity was non-specific infected beforehand, the diseases involved were

Cystis maxill sup ( $1 \times 1$ cm)	1 case
Cystis maxill sup ( $3 \times 3$ cm)	1 "
Cystis mandibulæ ( $3 \times 2\frac{1}{2}$ cm)	3 "
Cystis mandibulæ ( $1 \times 1$ cm)	1 "
Osteomyelitis ulnæ seq ( $2 \times 1$ cm)	1 "
Ostitis chr oss ilei ( $2 \times 2$ cm)	1 "
Abscess oss femoris ( $\frac{2}{3}$ of a hen's egg)	1 "
Abscess oss femoris ( $2 \times 2$ cm)	1 "
Cystis colli femoris ( $5 \times 3$ cm)	1 "

Cystis tibiae ( $5 \times 5 \times 6$ cm)	1 case
Osteomyelitis tibiae seq ( $2\frac{1}{2} \times 2\frac{1}{2}$ cm)	1 "
Osteomyelitis acuta in chr humeri ( $2\frac{1}{2} \times 4$ cm)	1 "
<hr/>	
Total 14 cases	

In 8 out of the 14 cases the process was fistulous towards the surface

If the cavity is infected, the filling may be successfully accomplished if the walls of the cavity are rendered sterile immediately before the filling is placed

Chronic non-specific bone abscesses, cavities after acute osteomyelitis, and infected bone cysts are often clearly limited and may in the operation be scraped completely clean of granulation tissue and cyst tissue. We have in these cases employed 2 *methods of sterilization of the cavity*, and both have been successfully accomplished, so that the filling gave a favourable result

At first we used the method described in the following example

291/1931 55-year-old male patient who in childhood had suffered from osteomyelitis in the lower part of right femur with fistula and discharge of sequestra. It healed in the course of about a year and during the following approx 45 years he had no symptoms of the disease. He was now admitted to hospital with swelling, redness, fever, and severe pain in the old place. It was found that he had a diabetes mellitus insons with blood sugar 263 and Mb cordis. By diet and insulin the blood sugar was reduced to 119 in the course of a week. Then operation, by which a large smooth-walled cavity (size  $5 \times 3 \times 2\frac{1}{2}$  cm) was found in right os femoris, filled with purulent granulation tissue and small sequestra. After scraping tamponade. During the following weeks the cavity was coated with a very thin layer of freshly red delicate granulations without edematous areas or fibrin. As there was little prospect of healing by tamponade such a large bone cavity in a diabetic of his age, it was decided to try sterilization and filling with plaster. Beforehand a number of inoculations from the surface of the granulation tissue was made, they all showed ample growth of staphylococci and Gram-negative bacteria on agar. The cavity was then filled with a sugar-methylviolet solution, in the wound we placed gauze moistened in the same solution and dressed with rubber-cloth to avoid staining on the bed-clothes. The next 6 days the dressing was changed daily, each time we inoculated from the surface of the cavity and from the edge of the skin with a small gauze tampon, which was placed in beef extract. After 24 and 48 hours we inoculated from the beef-extract glasses on agar, all the glasses with beef extract and agar remained in thermostat for at least 72 hours, there was no growth. Then filling with plaster and suture of the soft parts. The patient was out of bed 16 days after the operation and shortly afterwards discharged from hospital. By repeated

x-ray photographs taken in the time following the discharge it was seen that the filling diminished concentrically until an x-ray photo taken 6 months after the operation showed that it had disappeared. The patient was under observation until he died 7 years after from his Mb cordis. There was full function of the leg in all respects and no impediments, the scar was not indrawn.

This mode of operation was successfully used in 1 infected cases, but it has several disadvantages. In the first place, the conditions for a successful accomplishment are comparatively rarely found, as it is necessary that the cavity is covered exclusively with good firm granulations, and that there is not area where they are coated with fibrin or are hypertrophic or edematous. It is true that also in case of bad granulations it may happen after the sterilization that inoculations from the surface of the granulations do not show growth, but if we inoculated from their interior, we had always growth, and in conformity with this there was afterwards suppuration under the filling in spite of superficial sterility. The difference between the firm "good" granulations and the more or less "hypertrophic", edematous, "bad" is, as far as these experiences go, that the former are infected only on the surface, the latter also in the interior of the granulation tissue. Even when a bone cavity seems to be well-granulating, there is very frequently one or more small spots where the granulations are "bad". In several cases of this nature we have tried sterilization with sugar-methylviolet solution without achieving sterility. It is also a drawback in this method that even in favourable cases it is often necessary to wait several weeks before the filling can be placed, and it would be an advantage to avoid the numerous inoculations and the rather complicated dressings.

In most cases of infection we have used another, *less complicated method of sterilization of the bone cavity*. It is an assumption that it is possible (with curette or, if necessary, chisel) to remove all pathological tissue, so that everywhere the wall is formed by unaffected survivable bone, which after this treatment is only superficially infected. After that the cavity is rubbed with a small firm gauze tampon moistened with a 50 % solution of argent nitric and caught with e. g. a pair of Péan's forceps. The whole cavity is treated with argent nitric in this way up to its edge, and it must be observed that the adjacent soft parts do not come into contact with the caustic. It is now tamponed firmly with ordinary sterile gauze for a moment, so that it looks dry, and the

filling is placed as described above, i. e. the plaster is firmly compressed into all parts of the cavity. The soft parts are sutured, but since the soft parts are not sterile, drainage should be provided to the surface of the filling, or situation sutures may suffice. Some secretion from the soft parts will appear, but this does not affect the filling. If all pathological tissue has been removed from the cavity, and its surface has been sterilized with *argent nitric*, the filling will unite with the wall and is then resorbed in the usual way by the granulation tissue from the wall. A fistula down to the surface of the filling will persist until the plaster is completely resorbed, and there may often be plaster particles in the secretion. When the granulation tissue in the bone cavity has reached its opening, it will join the adjacent soft parts, and the fistula will close. The resorption of plaster will take place independently of the presence of the fistula in the soft parts, as a rule the patient may be discharged from hospital and attend to his work and need only be provided with a dressing for the absorption of the generally scarce secretion.

The advantages of this method of sterilization are that it may be applied at the first operation immediately after the cleaning of the granulation-filled infected cavity, that it may be used in granulating cavities previously operated upon, even though not all the granulations are "good", that it is quick and cleanly, and that the numerous inoculations are avoided.

In these 14 cases infected beforehand the bone cavities contained pus or purulent granulation tissue (or cyst-tissue). Inoculation showed growth of suppuration microbes except in 1 case, where there was no growth. 8 cases were fistulous.

4 out of these 14 cases occupy an exceptional position. One of them was the only one of all the cases where the filling was undertaken in direct connection with operation owing to *acute* recurrence of an old osteomyelitis. In the 3 other cases it was found when scraping the cavity that the process had ulcerated through the bone and through a small aperture communicated with the soft parts in the depth.

In these cases there was suppuration around the filling, which was subsequently removed. As far as the acute case was concerned, it is probable that not only the cavity, but also the adjacent bone canals are infected, and that sterilization of the surface would therefore not suffice. As far as the 3 cases with "interior bone fistula" are concerned, it was, of course, impossible to sterilize

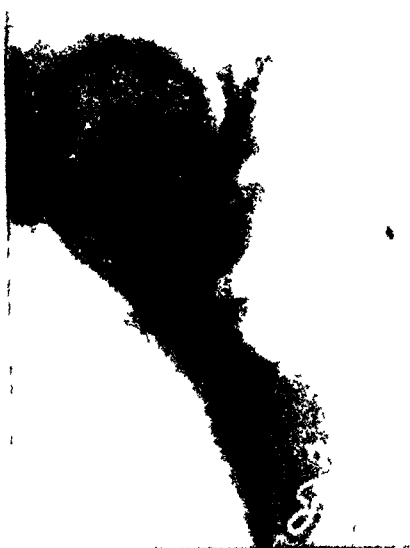


Fig 1 a ♂, 60 years old, cystis ulnæ  
before operation (13/1, 1939)



Fig 1 b 6 days after operation and  
filling with plaster of Paris



Fig 1 c 12 weeks after operation,  
plaster of Paris resorbed

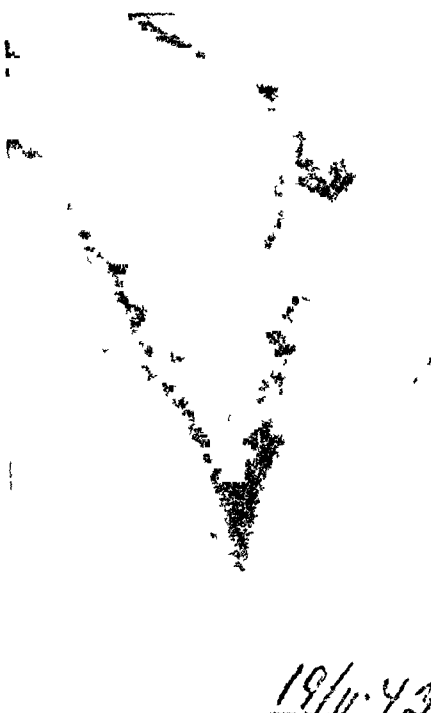


Fig 1 d 4½ years after operation,  
cavity partly ossified



Fig 2 a ♂, 10 years old, cystis mandibulæ  
before operation (13/6 1941)



Fig 2 b 7 days after operation and filling  
with plaster of Paris



Fig 2 c 2 1/4 months after operation,  
plaster partly resorbed



Fig 2 d 1 year 2 months after operation,  
cavity ossified

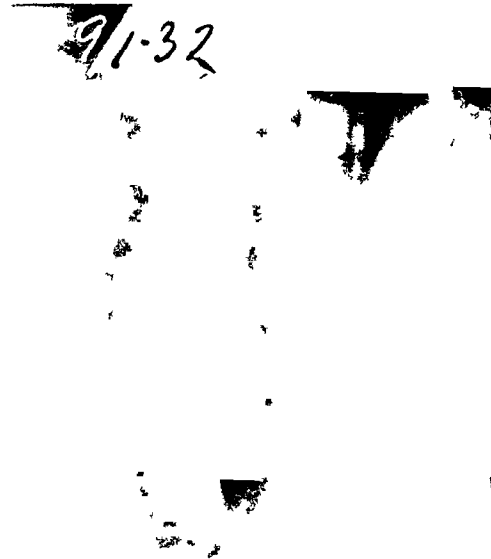


Fig 3 a ♂, 11 years old, cystis maxillæ sup  
few days after operation and filling with  
plaster of Paris



Fig 3 b 7 1/2 years after operation

Fig 4 a ♀, 22 years old, abscessus femoris, before operation

Fig 4 b 3 days after operation and filling with plaster of Paris

Fig 4 c 2 1/2 years after operation

AAGE NIELSEN Filling of Sterile and Infected Bone Cavities





the infected soft parts beyond the perforation of the bone, and the infection is therefore likely to have emanated from this source. In such cases filling should evidently be avoided, as might have been inferred in advance.

Out of the remaining 10 cases (6 of which were fistulous) the filling succeeded in 9, while the sterilization failed in one case. The course of these 9 cases was quite similar to those being sterile beforehand, apart from the fact that a fistula persisted in the infected soft parts down to the surface of the plaster. But when the plaster in the course of some weeks or months was resorbed, while the granulation tissue from the cavity had grown up to the soft parts, the fistula healed and did not appear again.

Judging from these experiences it must be assumed that filling with plaster will succeed also in infected cavities if the cavity is rendered sterile.

*The periods of observation after the filling were*

$< \frac{3}{4}$ year	5 patients
1— $1\frac{3}{4}$ 55	6    "
2— $3\frac{1}{2}$ 55	10   "
4— $7\frac{1}{2}$ 55	9    "

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Total 30 patients

Incidentally, the time of observation is of comparatively slight interest as to whether the filling succeeds or not. If only the filling had become firmly united with the cavity, the closure remained a success, and subsequently no suppuration appeared around the filling. None of the patients have subsequently been annoyed by the filling.

Among the plaster-filled cysts in the upper and lower jaw there were both follicular and radicular. If the tooth which forms the origin of the radicular cyst has not been extracted, the root must be treated as in Partsch's operation. There has, however, not been occasion to do this in any of the cases treated so far.

As already mentioned the tissue growing from the wall of the bone cavity and resorbing the filling possesses *osteogenetic properties*, so that the defect in the bone will gradually be filled with bone tissue. The reparative processes will also tend to give the bone its *normal form* (Fig. 2). If, for example, a cyst has dilated the upper or lower jaw, so that the bone has been considerably enlarged, it will be found that gradually as the plaster is resorbed the bone will practically resume its normal dimensions.

In contradistinction to fillings in all other localities it was found that filled *cysts in antrum Highmore*, even if they occupied the whole antrum, and although the plaster was resorbed concentrically in the usual way, did not ossify, but for years (e g 6 years) showed the same x-ray picture as a normal antrum, in some cases with a slightly or moderately diffuse veil (Fig 3) We have not had an opportunity to examine whether antrum in these cases is permanently filled with non-ossified granulation tissue, or whether this will gradually (at this localization) be resorbed Filling with plaster of the jaw cysts, particularly in case of medium-sized and large ones, has the essential advantage over Pautsch's operation that there is no further treatment after the closure when this succeeds, tampon treatment and communication between the mouth and the cystal cavity are avoided

### Summary.

An account is given of the technic and results of filling by means of plaster of Paris of sterile or chronic infected bone cavities. The material included 14 sterile cavities, 14 infected with non-specific microbes (thereof 8 fistulous), 2 with tuberculosis. If the cavity is sterile or is made sterile by careful scraping and rubbing with 50 % argentic nitricum, the filling will unite with it, and in course of the following weeks or months be concentrically resorbed by granulation tissue from the wall of the cavity. This tissue then fills the cavity. It has bone-producing properties. The ossification occurs most rapidly in young individuals.

### Zusammenfassung.

Es wird über die Technik und die Ergebnisse der Gipsplombierung von sterilen oder chronisch entzündeten Knochenhöhlen berichtet. Es handelte sich um 14 sterile Höhlen, 14 mit allgemeinen Eiterbakterien infizierte (darunter 8 fistulöse) sowie 2 mit Tuberkulose infizierte. Wenn die Höhle im Voraus steril ist oder durch sorgfältiges Ausschaben und nachfolgendes Auswaschen mit 50 %-iger Argentum nitricum-Lösung steril gemacht werden kann, so wird die Gipsplombe in der Höhle »einheilen« und im Laufe der folgenden Wochen oder Monate durch von den Wandungen der Höhle ausgehendes Granulationsgewebe konzentrisch resorbiert werden. Dieses Gewebe besitzt knochenbildende

Eigenschaften Die Ossifikation findet bei Jugendlichen am raschesten statt

### Résumé.

L'auteur relate la technique et les résultats du plombage au plâtre de cavités osseuses stériles ou chroniquement infectées. Il s'agissait de 14 cavités stériles, d'un nombre égal qui étaient infectées de microbes pyogènes ordinaires (dont 8 fistulées), et de deux autres avec de la tuberculose. Si la cavité est d'emblée stérile, ou si elle est rendue telle par un curettage soigneux suivi d'un écouvillonnage avec du nitrate d'argent à 50 %, le plombage plâtre «tiendra», et au cours des semaines ou des mois suivants il sera résorbé concentriquement par un tissu de granulations né des parois de la cavité. Ce tissu a des propriétés ostéoplastiques. L'ossification est plus rapide chez les sujets jeunes.

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# Acidosis and Alkalosis in Surgical Conditions

By

GOSTA BOHMANSSON, M D,  
Orebro

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The research of recent years has added to the store of knowledge of the fluid conditions of the organism. The importance of blood and plasma transfusions in shock and other conditions and the analysis of the relative content of serum protein and chlorides as a means of determining the correct dosage of the transfusion medium are now undoubtedly generally recognized. The acid-base balance of the blood and body fluids should also be taken into consideration in this connection.

Analysis of the cases in which clinical experience has taught us that the prognosis is poor, that the patient "will not survive an operation", will frequently show more or less pronounced acidosis.

In 1935 at a meeting of the Scandinavian Surgical Association in Copenhagen **ESBEN KIRK** reported on the results of studies on acidosis at the Bispebjerg Hospital and recommended the intravenous administration of Sodium bicarbonat solution in the treatment of this condition.

Renal acidosis and postoperative disturbances in the acid-base balance were discussed by **LEANDER** at meetings of the Swedish Surgical Association in 1938 and 1940.

**G H GIERTZ** published a paper on these questions in *Nordisk Medicin*, and a number of reports on the same subject have been contributed earlier from the Orebro Lasarett by **WILANDER**, **STIG LINDGREN** and myself, both at a meeting of the Swedish Surgical Association and at the Jydske Medicinske Selskab congress in Aarhus in 1941.

I now return to the problem of acidosis in order to demonstrate some typical cases from various categories, which illustrate that the knowledge of the existence of these disturbances and of the means of dealing with them is of the greatest importance to the outcome. The following case histories are presented as examples of a few conditions with acidosis.

#### Duodenal Fistula with Acidosis.

*Case 1* A man of 43 years was submitted to gastric resection with anastomosis according to Billroth II because of an anastomotic ulcer after a Billroth I operation. He was depressed and irritable even before the operation. A duodenal fistula appeared on the fifth postoperative day. This condition persisted for several weeks, during which the patient became progressively worse. Analysis of the blood showed the carbon dioxide combining power to be only 16 volume per cent. Consequently, 1,000 Gm. of isotonic bicarbonate solution was given intravenously. The carbon dioxide value returned to normal after two days' treatment, and the state of mind and general condition improved immediately. The duodenal fistula healed spontaneously five days after institution of the bicarbonate treatment, and the patient recovered.

The cause of the acidosis was the loss of alkali through the fistula.

#### Common Bile Duct Fistula with Acidosis.

*Case 2* A 69-year-old man was admitted with obstructive jaundice and acidosis. He was given pre-operative treatment with bicarbonate for three days. The carbon dioxide value then returned to normal, and the operation was done. A common duct fistula with extensive secretion developed, leading to acidosis with a carbon dioxide value of 28 volume per cent. Renewed treatment with bicarbonate acted promptly, the fistula healed and the patient recovered.

The loss of alkali was the cause of the acidosis in this case also. The preliminary acidosis was due to jaundice and hepatic lesion.

#### Renal Acidosis.

*Case 3* The patient was a 73-year-old man with prostatic hypertrophy with total retention and isosthenuria. The value for non-protein nitrogen was 59.

Two weeks later the patient began to have attacks of pyelitis with hyperpyrexia. Calcium mandelate was administered, but the patient became very ill, sluggish and comatose.

Analysis now gave a carbon dioxide value of 11 volume per cent and a non-protein nitrogen value of 150 mgm. per cent. The acidosis regressed and the non-protein nitrogen value decreased during medication with bicarbonate. The patient was discharged two months later in good condition and with normal non-protein nitrogen and carbon dioxide values.

### Prostatic Hypertrophy with Total Retention Uremia and Acidosis.

*Case 4* A man of 63 with total urinary retention was admitted. A catheter à demeure was inserted. The patient was apathetic and exhibited deep respiration, in other words, he showed clinical signs of uremia and acidosis, which were verified by the following laboratory findings: non-protein nitrogen, 158, carbon dioxide, 15.

Due to poor drainage through the catheter, a vesical fistula was made the day after admission, and the patient was given bicarbonate solution intravenously for two consecutive days. The uremia and acidosis were checked very quickly. Normal values were registered on the third day after the administration of bicarbonate.

The acidosis was the result of the renal injury, which gave rise both to the retention of acid products and to a disturbance in the formation of ammonia, which under normal conditions can provide compensation for a surplus of acids.

Calcium mandelate or an acid-forming diet is directly harmful in cases of this kind. Carbon dioxide analysis will reveal the nature of the case and indicate the right treatment.

### Gastric Fistula with Alkalosis and Hypochloremia.

*Case 5* A 15-year-old girl was treated with a gastric fistula for spontaneous acute dilatation of the stomach. Fluid was administered intravenously, but the patient suffered from a great loss of chlorides. The carbon dioxide value rose to 70, and the chlorides dropped to one-third normal. The patient went into a deep coma, and the prognosis seemed very poor.

The intravenous administration of large amounts of 10 per cent sodium chloride raised the chloride value and checked the alkalosis; the patient regained consciousness and soon recovered after the fistula had healed.

Here we have an example of hypochloremic azotemia and alkalosis appearing in connection with important chloride losses, on which the administration of hypertonic sodium chloride had an excellent effect.

### Acid Vomiting with Alkalosis.

*Case 6* The patient had undergone gastric resection with a Billroth I anastomosis and enjoyed an uneventful convalescence until the tenth day, when severe vomiting began. Another operation was considered. Analysis revealed non-protein nitrogen, 104, carbon dioxide, 58, and chlorides, 291, in other words, distinct alkalosis and hypochloremia.

Hypertonic sodium chloride acted immediately. The vomiting ceased, blood analysis gave normal values, and the patient recovered.

This case illustrates the importance of a detailed blood analysis and the effect of the right treatment.

I shall not bore the reader with further case histories. Many similar cases should be selected from our records, but I only wish to illustrate with a typical case from each group the clinical significance of the acid-base balance.

I shall now give a brief summary of the concept, acidosis, the clinical picture and symptomatology of the disease, its causes and the means of combating it.

*Acidosis* has been known for one hundred years, ever since O-SHAUGHNESSY's attempts to treat cholera with alkali. The term acidosis, however, was not introduced until 1906 by NAU-  
NYN to designate ketonemia in diabetes.

The degree of acidosis can be expressed in the hydrogen ion concentration of the blood, but the carbon dioxide combining power of the blood is a more sensitive indicator. The bicarbonate content is determined at the carbon dioxide pressure normally found in the blood, we report this value in volume per cent.

The carbon dioxide value in the blood provides a clinically practical gauge of acidosis. In acidosis the carbon dioxide value is lower than normal, in alkalosis higher. With the method we use in Orebro, a modification of the VAN SLYKE method, reported by ODIN the normal value is between 40 and 45 volumes per cent.

### Clinical Picture and Symptomatology.

In mild acidosis the patient sometimes complains of tiredness and inertia, headache, loss of appetite and a feeling of nausea. Faulty power of concentration and apathy are occasionally observed. The patient does not have the energy to "eat, speak or read." Not seldom the tongue is dry, which symptom KIRK states is much more common in acidosis than in dehydration.

In more severe cases, more or less pronounced air hunger with deep respiration is observed. Unconsciousness is a later development.

However, as demonstrated above, decreases in the carbon dioxide value down to 16 and 20 volumes per cent can occur without any grave clinical signs, and as a rule slight decreases in the carbon dioxide figure are not accompanied by symptoms.

Pronounced acidosis is characterized by vomiting, muscular pain and loss of weight, partly due to dehydration and partly to cellular disintegration.



### Causes of Acidosis.

There are two main causes of acidosis accumulation of acids and extensive loss of alkali

Accumulation of acids is found, for example, in diabetes as a result of abnormal acid formation (beta-oxybutyric acid and diabetic acid), in acid retention, renal insufficiency and, finally, in acid poisoning of various kinds

Loss of alkali is seen in severe diarrhea, in intestinal and biliary duct fistulas

### The Neutralizing Mechanism of the Organism.

Acid formed in the body or administered to it is neutralized in particular by the bicarbonate of the blood but also by the blood protein and phosphates The surplus of acid is excreted by the urine either as highly acid urine or bound to the alkaline salts or ammonia

Ammonia is formed in the kidneys If the kidneys are injured, the formation of ammonia suffers and instead the alkali supply of the organism must be used to bind the acids

Organic acids are often neutralized through oxidation

### Clinical Forms of Acidosis of Interest to the Surgeon

#### 1 *Loss of Alkali*

Fistulas in the biliary passages, pancreas, duodenum, small intestine, and in the large intestine accompanied by diarrhea Simple diarrhea Hyperemesis of pregnancy, nervous anorexia (with alkaline vomiting)

#### 2 *Abnormal production of acid*

Diabetes, starvation, narcosis

#### 3 *Retention of acid with loss of alkali (renal acidosis)*

Acute and chronic nephritis

Eclampsia

Prostatic hypertrophy with renal lesion, hypernephrosis

Pyelonephritis and other surgical renal diseases

#### 4 *Acidosis of unclear etiology*

Hepatic diseases with jaundice

Renal acidosis is of special interest. A rise in non-protein nitrogen may develop without renal lesion as a result of a loss of salt and of dehydration. This form of "uremia" has another pathogenesis than the renal form. In dehydration the kidneys are not diseased, the renal function is lowered, but the ability to function remains. The prognosis of this uremia is thus good, if the lack of salt and the dehydration are checked. The acidosis itself often gives rise to an increase in non-protein nitrogen in the blood. KIRK considers this to be due to tissue disintegration, and drew attention to the fact that the administration of bicarbonate can put an end to the tissue disintegration and the acidosis.

### The Treatment of Acidosis.

The administration of 1.3 per cent sodium bicarbonate solution generally has a dramatically quick effect. The injection can be given intravenously or intrasternally, but preferably not subcutaneously.

If the patient exhibits manition, glucose and plasma should also be given. It is important that the bicarbonate not be permitted to boil uncovered, since it will then be decomposed into soda. It should either be sterilized in the autoclave in air-tight, stoppered bottles, or else the salt should be dissolved in already autoclaved  $H_2O$ , which should suffice for intravenous administration.

In renal acidosis it is advisable to give one to two grams of calcium gluconate per liter at the same time, since low calcium values generally accompany phosphate retention in the blood.

Bicarbonate given orally can also be tried in chronic diseases of the kidneys.

The effect of bicarbonate on advanced cases is often marked and rapid. The dosage should be checked by analysis of the carbon dioxide values in order to avoid over-dosage and alkalosis. The risk of over-dosing is greatest in renal acidosis.

Other workers recommend sodium lactate (HARTMANN) as more durable and easier to administer. The advantage of this substance is that alkalosis due to over-dosage can be avoided. We have no experience with this method, since bicarbonate gave good results and since the risk of alkalosis is insignificant as long as the carbon dioxide values are followed.

## Alkalosis

Alkalosis is mainly found in patients who have lost acid matter from the stomach through vomiting or gastric fistulas. The loss of chlorides is often large in this connection, and the result is frequently a rise in non-protein nitrogen.

The symptoms are non-characteristic. In advanced cases one sees tetany and, finally, coma. As a rule the alkalosis is followed by pronounced hypochloremia.

The treatment consists of the administration of sodium chloride in isotonic or hypertonic solution. The dosage in such cases also should be planned after analysis of the chlorides.

In addition to the literally life-saving significance of the treatment directed at changes in the acid-base balance, this treatment appears to play another and perhaps equally important role. It is a fact that both acidosis and alkalosis have a destructive effect on the tissue cells, and it may be that many cases which appear unresponsive and hopeless could be put into another and better reaction phase by the restoration of a normal acid-base balance. It is surprising that, although acidosis and its treatment have been known for as long a time as 110 years in the treatment of cholera, this theory did not ages ago become recognized by the surgeons and that it has not had a stronger influence in the field of surgery.

Apart from protein analyses and chloride determinations in the serum, as well as what is known of dehydration and conditions with surplus fluid in the body, analysis of the acid-base balance is of exceedingly great assistance in the choice of the right moment for an intervention and in the conquering of dangerous postoperative complications.

In order that the analysis be of adequate clinical use, it should include determination of the following factors:

Hematocrit, serum protein, chlorides or sodium chloride, non-protein nitrogen and carbon dioxide combining power. With these values in hand, we are able to evaluate the various factors which will determine the choice of injection fluid and the amount thereof.

### Summary.

The writer emphasizes the importance of analysis of the acid-base balance in the blood in several different surgical diseases. This is done by determining the bicarbonate content of the blood at normal carbon dioxide pressure.

The carbon dioxide combining power figure is a clinically practical measure of the degree of acidosis and alkalosis.

The writer draws attention to the fact that even mild changes in the acid-base balance may give symptoms and that they are primarily manifested in lack of interest in life and of will power.

Case histories are given to illustrate the various conditions in which acidosis can be expected, such as alkaline loss in intestinal fistula, renal acidosis in different renal lesions and alkalosis with hypochloremia in gastric fistula and acid vomiting.

The treatment consists of intravenous or intrasternal administration of 1-3 per cent sodium bicarbonate solution in acidosis and of hypertonic sodium chloride solution in alkalosis, the effects are often striking and rapid.

In addition to the fluid and colloid balance, the acid-base balance in shock is worthy of careful attention in connection with many surgical and postoperative conditions.

### Zusammenfassung.

Verf. betont die Bedeutung einer Analyse des Saure-Basengleichgewichtes im Blute bei verschiedenen chirurgischen Krankheitsfällen. Dies geschieht durch Bestimmung des Bikarbonatgehaltes des Blutes bei normalem  $\text{CO}_2$ -Druck.

Der  $\text{CO}_2$ -Wert des Blutes stellt ein klinisch verwendbares Mass des Azidose- bzw. Alkalosegrades dar.

Verf. betont, dass selbst leichte Störungen des Saure-Basengleichgewichts klinische Symptome geben können und sich vor allem in mangelnder Lebenslust und mangelndem Willen manifestieren.

Durch Krankengeschichten werden die verschiedenen Zustände veranschaulicht, bei denen eine Azidose zu erwarten ist, wie z. B. Alkaliverluste bei Darmfisteln, renale Azidose bei verschiedenen Nierenschädigungen, andererseits Alkalose mit Hypochloremie bei Magenfisteln und saurem Erbrechen.

Die Therapie besteht in intravenöser oder intrasternaler Zufuhr von 13 %iger Natriumbikarbonatlösung bei Azidose, von hypertonischen NaCl-Lösungen bei Alkalose und gibt oft auffällige und rasche Wirkung

Neben der Flüssigkeits- und Kolloidbilanz beim Schock verdient das Saure-Basengleichgewicht bei vielen chirurgischen und postoperativen Zuständen sorgfältige Beachtung

### Résumé.

L'auteur fait ressortir l'importance d'une analyse de l'équilibre acido-basique dans diverses affections chirurgicales. On y procède en déterminant la teneur du sang en bicarbonate sous une tension normale de l'acide carbonique.

Le chiffre du  $\text{CO}_2$  dans le sang est une mesure, utilisable cliniquement, du degré d'acidose ou d'alcalose.

L'auteur souligne que des troubles même légers de l'équilibre acido-basique peuvent donner des symptômes cliniques et se manifester avant tout par un manque de vitalité et par de l'abou-  
lie

Par des observations de maladies il illustre les différents états où l'on peut s'attendre à de l'acidose tels que les pertes alcalines dans les fistules intestinales, l'acidose rénale dans diverses lésions des reins, ainsi que l'alcalose avec hypochloremie dans les fistules gastriques et les vomissements acides.

Le traitement, qui consiste en administration intraveineuse ou intrasternale d'une solution de bicarbonate de soude à 13 % dans l'acidose, ou de solutions hypertoniques de NaCl dans l'alcalose, donne souvent des résultats frappants et rapides.

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# Plastic Surgery of the Ligaments of the Knee.

By

IVAR PALMER, M D

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It is possible in the knee joint to reinforce with a tendon transplant an insufficient ligament or replace a ligament absorbed following a rupture. The transplant in this case can either be detached from or allowed to retain its inferior insertion on the tibia.

This type of intervention, however, can scarcely be said to be a popular one. Although a good many reports of one or more cases have been published, experienced traumatologists, including BOHLER and WATSON JONES, warn against these operations and MACGURIE goes so far as to state categorically that the operation "could not give any benefit other than that derived from the period of immobilization following it."

Unfortunately no case has ever been published in which the period of observation after one of these operations was long enough.

One cannot but understand the strong skepticism entertained by many surgeons with regard to the type of operation in question. For many legitimate objections and questions can be raised on theoretical as well as practical grounds as to the suitability of this mode of procedure.

The first question to arise is whether a tendon running freely through the joint will endure. Will it not become subject to absorption processes and finally disappear? This particular objection I should like to meet at once on the basis of my own experience. In one of my cases, which was operated on nine years ago with typical plastic repair of the anterior crucial ligament according

to the Hey-Groves method, a second arthrotomy was done two years later for lateral meniscal injury with locking. The latter operation revealed a well-preserved tendon band running through the joint in the place of the crucial ligament, the only apparent difference being that the new band was somewhat narrower and more rounded than a normal crucial ligament. It was covered with vascular synovial tissue. When attempts were made to elicit the "drawer forward" phenomenon, the new ligament contracted beautifully and checked the displacement.

Histologic examination of a specimen in another case, in which the patient died of pulmonary embolism six weeks after the operation, revealed that the tendon flap, which was taken from the ileotibial band with retained inferior insertion, consisted of live tissue both in the drilled bony canals and in the joint. Vessels growing in from the surrounding tissue indicated that healing was taking place (fig 1). It may be added that this case represented the only death and also the only complication in my series.

Thus I was able to prove that a tendon flap of the type in question can grow into place and become permanent. However, there are good reasons to raise other objections, which are more difficult to refute. The physiologic series of movements in the knee joints is a complicated procedure. A movement of flexion from full extension begins with rotation — the final rotation of the extension is completed — after which the femoral condyles roll backward about 20 degrees over the tibial plane, whereupon the rolling is replaced by spinning on the same spot, like a wheel of a skidding automobile. During this movement the ligaments act as check reins, but not with uniform tension. Portions of ligaments with varying functions succeed one another, changing position in relation to each other according to the rôle each one is called upon to play. But — and here we come to what probably constitutes the weightiest objection — the ligaments do not act as check reins only. In fact they have another parallel function of great importance in the movement physiology of the joint, serving as terminal apparatuses for the neurogenic component of the joint. The ligaments are well supplied with nerve tissue. Actually they constitute an exciting organ for the muscular defense reflexes of the joint! The tensing of a ligament activates a group of muscles with which it is connected functionally. It is through this mechanism alone that the bands are able to resist the often violent strain to which they are submitted during the course of a lifetime.

Can a transplanted flap of tendon perform all these tasks? The answer to this question must be negative, unless it is assumed that a certain degree of functional adaptation is feasible in the connective tissue of the tendon flap, as in the bones. This assumption may appear fantastic, still it is conceivable that it has a certain basis of truth. When a pseudarthrosis is bridged with a graft of bone, the factor that makes the operation a permanent success is not the graft, nailed or fastened into place, but the living bone tissue which replaces the graft.

Final judgment, however, should rest on practical experience, in face of which theoretical considerations will be silenced. Hence I considered it worth while to make a follow-up examination of my cases of plastic surgery on the ligaments of the knee, in some of which as much as ten years have elapsed since the operation.

First I should like to say a few words about the routine treatment of ligamentous insufficiency in the knee joint. To begin with an attempt should be made to strengthen the muscular protection of the joint by vigorous physiotherapy. Only when this fails should one resort to surgery.

The operations in my series were not conducted according to any fixed technique. The procedure was not modified, however, on the basis of the results of follow-up examinations, but rather according to primary technical experience gained from the operations themselves.

The types of instability which may require surgical treatment are as follows:

- 1 "Drawer forward" with abduction instability
- 2 "Drawer backward" with or without abduction instability
- 3 Pronounced abduction instability
- 4 Pronounced adduction instability

The first type is the commonest, being a result of the most prevalent form of subluxation in the knee joint — subluxation in flexion-supination-abduction. In these cases, first the medial collateral ligament and then the anterior crucial band ruptures, the latter becoming caught over the inner margin of the lateral femoral condyle. The rupture occurs in the superior insertion or in the substance. If primary suturation of the ligament is not done, the fragments of the bands fall down toward the floor of the joint, become squeezed between the articular surfaces and are gradually absorbed. Consequently, the anterior crucial band is



generally entirely or partly absorbed by the time of the operation. The medial collateral ligament is relaxed and scarred, but is usually healed with retained continuity.

The purpose of the typical Hey-Groves plastic operation is to reconstruct the anterior crucial ligament. A flap from the iliotibial band, with the inferior insertion intact, is drawn through the

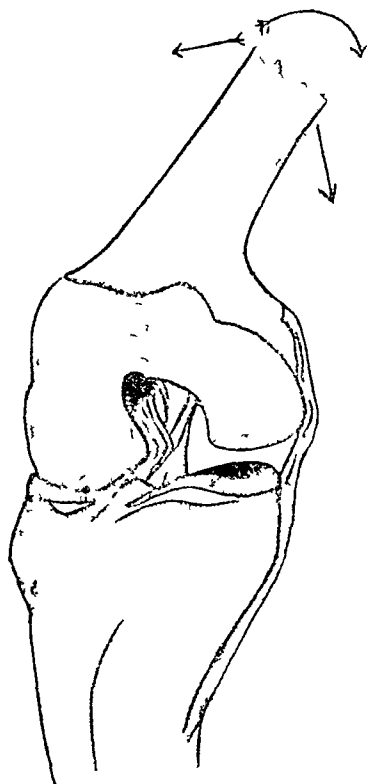


Fig 2 The position of the heads of the joint and ligaments in combined abduction-supination-flexion subluxation. The tibial collateral ligament "over-stretched" the medial femoral condyle thereby free and rotated backwards. The anterior crucial ligament in a vulnerable position stretched over the edge of the lateral condyle.

lateral femoral condyle, through the joint and then through the anterior margin of the tibia, where it is attached with sutures. The objection can be raised forthwith that insufficiency of the anterior crucial band scarcely requires operative treatment. Not until the lateral bands also exhibit insufficiency does the injury become truly incapacitating and muscular compensation difficult.

For plastic operations on the ligaments in instability of the



Fig 1 a Photomicrograph Section through the end in the lateral femoral condyle with a tendon roll from the iliotibial tract

Fig 1 b Section through the intra-articular part of the tendinous graft It is covered by a thin synovial membrane and healed into the intercondylar fossa with no signs of tissue irritation



"drawer forward" type I have evolved a modified Hey-Groves method, the aim of which is general reinforcement both of the anterior crucial band and of the two lateral bands. A flap is fashioned from the iliotibial band, 15 cm long, 3 cm broad at its upper end and 1 cm broad at its lower end. The flap is tapered in this way in order to compensate for the greater thickness of the band at its lower end.

A tunnel one-half centimeter in diameter is drilled through the lateral femoral condyle from the bulge of the epicondyle itself to the posterior margin of the condyle in the intercondyloid fossa. One of the most important details in the operation, if the reconstructed ligament is to function properly, is to make sure that the tunnel issues far enough posteriorly. If it issues too far forward, the band when contracted will limit extension and, as happened in one of my cases, will rupture or become over-stretched during the after-treatment for the purpose of eliminating the postoperative restriction of extension.

The flap is drawn on through a tunnel in the tibia from the crucial band's old insertion in the anterior intercondyloid fossa. The tunnel issues medially a couple of centimeters below the articular margin and in the medial collateral ligament itself. From here the flap is turned upward and drawn through a tunnel in the tendon insertion above the medial epicondyle on the femur, duplicated, and buried in the retinaculum mediale. The success of the whole operation depends on having the canals issue at the right places. If the drilling is done haphazardly, one may easily land in the wrong part of the interior of the joint. A new tunnel cannot be drilled if this happens, because too much of the bone substance of the condyle will be destroyed.

Meanwhile I have evolved a method whereby absolute accuracy can be secured. First I use a guide wire, until I get the right course for the canal. The final drilling I do with a special tubular bore which is perforated lengthwise and through which the guide wire can be threaded.

Inside the joint the flap is carefully covered with a piece of the intermediate septum — if the latter is intact — which is divided as far forward as possible for the purpose. If this excellent material is not available, the synovial membrane of the remains of the crucial band is used to cover the flap. This process is undoubtedly of importance to the nutrition of the flap and to its healing into place.

The result of this method is a flap which

1 reinforces the lateral collateral ligament by passing from the tubercle of the tibia to the lateral femoral epicondyle,

2 provides a substitute for the anterior crucial band in whose place it is firmly fixed in two long bony tunnels, where it grows into place,

3 reinforces the medial collateral ligament, over which it passes, doubled over and attached with silk sutures buried in the retinaculum mediale (Fig 3)

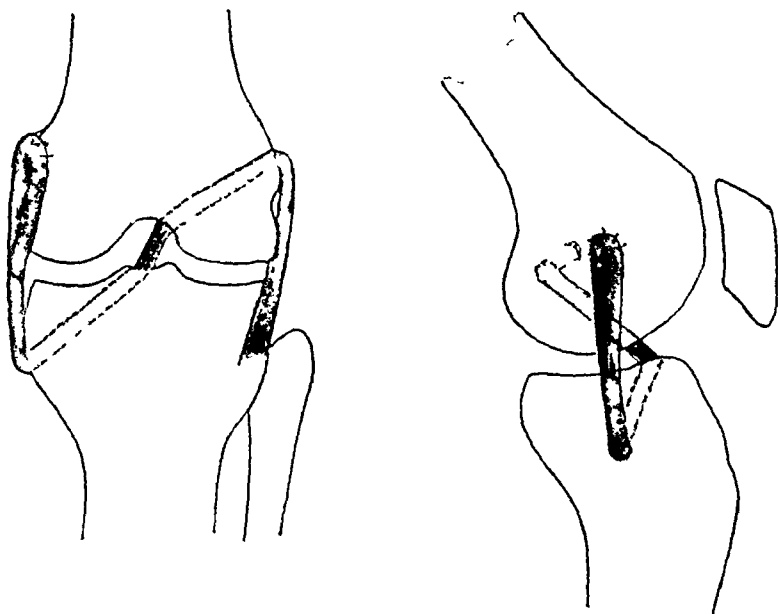


Fig 3

The technical difficulties of this operation are easily overcome, and the anatomic conditions are favorable

Meanwhile, instability of the "drawer backward" type is another kettle of fish. In an earlier paper I suggested that the lateral half of the semimembranosus tendon split longitudinally be used in this connection. It has been found, however, that this tendon is too short to allow for a sufficiently firm footing outside the bone canal, which in this case is made through the medial femoral condyle after the tendon has been drawn through the joint from the back. The method is further unsatisfactory, because there is no possibility of reinforcing the lateral ligaments at the same time. The attachment is unreliable, displacement can scarcely be avoided,

and the whole tendon is too thin and weak. A flap from the iliotibial band provides much stronger and better material than any tendon in the muscles of the knee, and it can be made as long as desired. The posterior crucial band, however, is attached to the inner aspect of the medial femoral condyle, while the iliotibial band is situated on the lateral aspect of the joint. But with the improved method of drilling it is possible to construct a curved tunnel. This is done in two stages. First a tunnel is bored from the outer aspect of the lateral condyle over the floor of the intercondyloid fossa and into the substance of the medial condyle. Then a second tunnel is chiselled from the attachment of the posterior crucial band up to unite with the first tunnel, the position of the attachment of the band makes it easily accessible. The flap is drawn through the posterior part of the capsule out into the posterior intercondyloid fossa on the tibia. From here — at a spot corresponding exactly with the inferoposterior attachment of the posterior crucial — a tunnel is bored through the tibia and issues in the medial collateral ligament. The flap is directed upward, drawn through the tunnel and duplicated, as in the operation described above.

The result is therefore a flap which

- 1 reinforces the lateral collateral ligament,
- 2 provides a substitute for the posterior crucial band, by being given the same situation as the latter, and reliable fixation in two long bone canals,
- 3 reinforces the medial collateral ligament (Fig 4)

In cases with pure lateral instability or lateral instability with only a moderate drawer sign, superficial reinforcement will be found to suffice. In instability in persons over 45 years of age, this minor operation would appear advisable. For example, the medial collateral band easily can be strengthened with the semitendinosus tendon, split as high up as possible, which is drawn through a tunnel in the adductor's attachment and then duplicated and buried in the retinaculum.

It is much more difficult to strengthen or replace the lateral ligament in adduction instability. If a flap from the iliotibial band is drawn directly from the tibial tubercle through the femoral condyles, the course of the new ligament will be unfavourable from a leverage viewpoint. It must be endeavored to secure an attachment on the head of the fibula. This is practicable if the

iliotibial flap is first drawn through a drilled canal in the head of the fibula and from there pulled tightly upward and straight through the femur. Reliable triple reinforcement is secured in this manner.

I have performed plastic ligament operations in altogether 19 cases. The period of observation amounts to ten years in the oldest cases. The function is perfect in the group of cases in which I have labeled the operative results "very good." In these the range of motion is normal, and the stability is the same as on the healthy side. This group includes one case which already exhibited mild

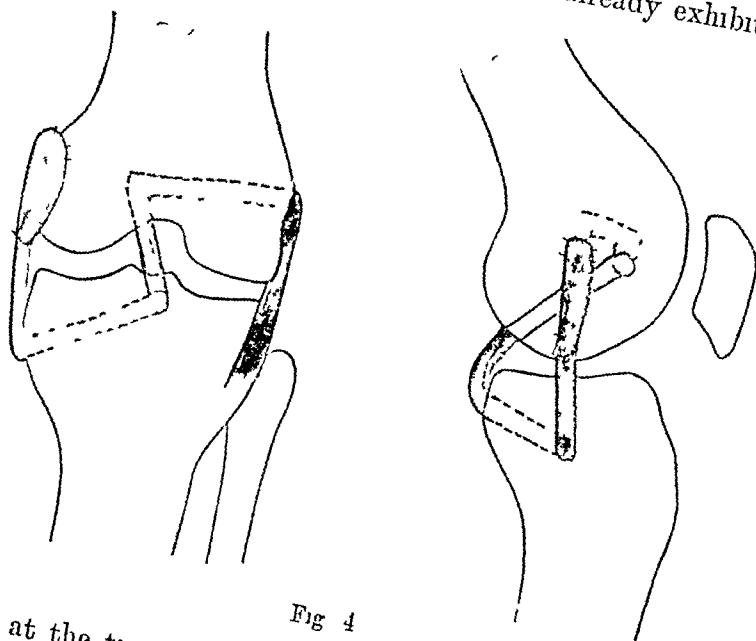


Fig 4

arthrosis at the time of the operation, seven years ago. Control roentgenograms taken recently showed that the arthrosis had not progressed.

As a gauge of the function I have used the patients' status in the army. I found that six of the seven patients in the group were able to complete their military service without sick leave on account of their knee injuries. Five of the six are athletes. One of them — a noncommissioned officer in the navy — who was an invalid before the operation in 1941 due to instability and whose tibia could be dislocated in front of the femur, now enjoys complete stability, and is an active sportsman and gymnast. All the members of the group report that they are not aware of any difference between the healthy and the operated knee. One of

them does clerical work in the army, due to spinal insufficiency, but his knee joint is healthy

In the case in which the result is labelled "average", the canal through the lateral femoral condyle issued too far forward in the intercondylar fossa. The patient therefore exhibited a limitation of extension for a while after removal of the cast. This disappeared rather suddenly, but at the same time there developed a moderate, though distinct "drawer" sign. Presumably the flap had slipped in the canal. On examination nine years later the "drawer" sign was still present.

One of the patients had severe arthrosis following fracture of the tibial condyle and injury to the ligaments. The effect of the operation was poor in this case. The arthrosis has progressed since the operation. The man is employed, however, and his condition is not worse now than before the operation.

In one of the cases operated upon for injury to the posterior cruciate band, the results of the operation may be said to be very good. The patient enjoys full stability and is working as a stevedore.

In two of the cases the results were average or poor, and in one the operation was performed too recently for after-examination. These cases permit of no definitive conclusions, but the results bear out what has been said regarding a suitable operative method.

The plastic operations on the lateral ligaments using the semitendinosus tendon showed satisfactory results, those on the lateral bands are too recent for postoperative observations.

To summarize, I would emphasize the following points:

1. Plastic repair of the ligaments should be done only in cases of pronounced ligamentous insufficiency, in which the compensatory muscular protection cannot be mobilized by means of physiotherapy.

2. Interventions aimed at general reinforcement should only be carried out on "plastically minded" persons under 40 years of age.

3. Correctly done and followed by carefully supervised postoperative treatment, the operations can be expected to give excellent results.



*Types of instability*

Drawer forward with abduction instability	Insufficiency of anterior crucial band and medial collateral ligament
Drawer backward with or without abduction instability	Insufficiency of posterior crucial band with or without insufficiency of medial collateral ligament
Highly pronounced abduction instability	Insufficiency of medial collateral ligament (and of anterior crucial band) following damage to crucial band
Highly pronounced adduction instability	Insufficiency of lateral collateral ligament (and of anterior crucial band) following damage to crucial band

*Operative results*

Type of insufficiency	No operated cases	Deaths	Very good results	Mode rate results	Poor results	Patients inaccessible of observation period too short
Anterior crucial band and medial collateral ligament	12	1	7	1	1	2
Posterior crucial band with or without medial collateral ligament	4		1	1	1	1
Medial collateral ligament (and anterior crucial band)	2		2			
Lateral collateral ligament (and anterior crucial band)	1					1
Total	19	1	10	2	2	4

*Summary.*

A description is given of follow-up examinations of 19 cases submitted to plastic operations for inveterate injuries to the ligaments of the knee joint with "loose" joint. In 12 cases the operation concerned the anterior crucial band and medial lateral ligament, in 4 cases the posterior crucial band, and in 3 cases the lateral bands.

General reinforcement of the ligament apparatus was the object of the operations. The material of choice is a flap from the ilio-tibial band. The flap can be made long enough to permit reconstruction of both lateral bands and one crucial ligament.

Histologic examination of one case, in which death occurred, and inspection of the joint in another, in which the joint was opened for the second time due to meniscal injury, revealed that the reconstructed ligaments had survived and grown into place

The operative technique, which is easily mastered, is described

### Zusammenfassung.

Verf teilt die Ergebnisse einer Nachuntersuchung an 19 Fällen mit, die wegen verschleppter Ligamentverletzungen im Kniegelenk mit Schlottergelenk mittels Ligamentplastik operiert waren. In 12 Fällen wurde die Operation wegen Verletzung des vorderen Kreuzbandes und des medialen Seitenbandes vorgenommen, in 4 Fällen wegen Verletzung des hinteren Kreuzbandes, und in 3 Fällen wegen Verletzung nur der Seitenbänder.

Verf hat bei der Operation die Schaffung einer allseitigen Verstärkung des Bandapparates angestrebt. Als Material ist ein Lappen aus dem Tractus ileotibialis das beste. Dieser kann lang genug gewählt werden, um für die Rekonstruktion der beiden Seitenbänder und eines Kreuzbandes auszureichen. Histologische Untersuchung bei einem gestorbenen Falle und Inspektion des Gelenks bei einem anderen Falle, wo wegen einer Meniskusverletzung erneute Arthrotomie vorgenommen wurde, ergaben, dass das rekonstruierte Ligament am Leben bleibt und in seine neue Umgebung hineinwächst.

Die Operationstechnik, die nicht ohne ihre Schwierigkeiten ist, wird beschrieben.

### Résumé.

L'auteur communique le résultat des examens de contrôle de 19 cas de plastique ligamentaire pour lésions invétérées portant sur les ligaments du genou et s'accompagnant de ballottement articulaire. Dans 12 cas l'opération avait été dirigée contre les dommages au niveau du ligament croisé antérieur et du ligament latéral interne, dans 4 il s'agissait du croisé postérieur et dans 3 uniquement des ligaments latéraux.

Lors de ses interventions l'auteur s'est efforcé d'obtenir un renforcement de toutes les parties de l'appareil ligamentaire. Quant au matériel à utiliser, c'est un lambeau pris sur le tractus

iléo-tibial qu'il faut préférer. On peut lui donner une longueur assez grande pour qu'il suffise à la reconstruction des deux ligaments latéraux et d'un croisé. L'examen histologique d'un cas après décès, et l'inspection de l'intérieur de l'articulation dans un autre où l'on pratiqua une nouvelle arthrotomie pour lésion méniscale, ont montré que le ligament reconstruit reste vivant et s'implante dans son nouveau milieu.

Description de la technique opératoire, qui n'est pas dépourvue de difficultés

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From the Department of Surgery of Statshospitalet, Sonderborg  
(Chief Surgeon JOHS IPSEN)

## **Determination of the Extent of Thyrotoxicosis by Measuring Pulse Pressure and Pulse Rate According to the Method of Zander-Liljestrand.**

By

JOHS IPSEN

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The following is a discussion of a method for the determination of the extent of thyrotoxicosis, possessing the advantage above the metabolic test that it is more easily practicable in hospital wards and even applicable in private houses. It can control the determination of oxygen intake and possibly replace it, where it cannot be effected, either because the apparatus is not available or because the condition of the patient (e. g. during and immediately after an operation) does not allow of this method of examination. Finally it especially aims at a factor of decisive importance to the operative indication, the cardiac activity.

The limited space does not permit of a discussion of the physiological principles underlying the method nor the actually not very comprehensive literature on the subject. Only the investigations made will be reported. The well-known importance of the metabolic test will not be submitted to further discussion either. But it must be emphasized that in spite of all precautionary measures one may occasionally arrive at a figure inconsistent with the clinical picture. Technical mishaps, the susceptibility of the patients, which is especially marked in case of Graves' disease, have the effect that the results are not always equally reliable, quite apart from the subjective judgment that decides whether a curve is applicable or not. In our Department we have taken the

best possible precautionary measures. The patients have been subjected to the usual diet. They are placed in a ward containing a KROGH metabolimeter and are accustomed to breathe through the apparatus before the examination is effected by a special, trained doctor at 8 a.m. before the patient who is kept in bed, has had breakfast or washed, etc. Nevertheless it does happen that the results are unreliable.

The methods for determining the cardiac function (especially the determination of the output per minute) will not either be discussed further. Some of them, e.g. GROLLMANN's method and its modifications are so elaborate and require such insight and practice (the air determinations) that they must remain in the hands of a few experts and never can become general clinical methods. The same thing is true of these methods as of so many others that they reveal rather high variations, partly from individual to individual, and partly in the same person. As a rule it is impossible to decide whether the variations mentioned are due to errors in the technique of the individual examination or to actual physiological alterations in the individual person.

Apart from GROLLMANN, there are others (BROEMSER, READ, et alii) who use the pulse pressure to determine the cardiac output. Lacking the personal experience I cannot give my opinion as to the value of these methods. In our Department we have exclusively used the ZANDER method. It assumes that there is a certain correlation between the pulse pressure (the amplitude) and the output per beat (the amount of blood expelled per heart beat). The more blood is pumped into the aorta the higher the systolic pressure. But if the diastolic pressure is high (raised blood pressure) the same amount of blood pumped in will cause a greater rise in the pressure than if it were pumped into a relatively slack aorta (low blood pressure). The result is that patients with a raised blood pressure show a relatively high amplitude, although the output per beat is unchanged. ZANDER now tries to correct this disadvantage by what he calls the "reduced amplitude". He multiplies the difference in pressure (the amplitude) by 100 and divides by the mean pressure (half of the sum of the systolic and diastolic blood pressure) which normally is about 100. He thereby obtains a correction in case of raised and low blood pressures. The figures arrived at correspond to the findings by GROLLMANN's methods in case of raised blood pressure, i.e. the output per minute and per beat is practically independent of the blood pressure.

It must be admitted, however, that in certain circumstances which we do not know at the moment, the reduced amplitude (or rather the pressure-corrected amplitude) is no absolute expression of the output per beat. If the aorta is less elastic (arteriosclerotic) the rise in the pressure will be much higher on account of the inelasticity of the aortic wall. This, however, hardly is of any importance in case of patients suffering from Graves' disease who mostly are youngish persons.

Whatever may be said about the theory of this method, the patients suffering from Graves' disease reveal a rise in the product of the pulse rate and ZANDER's "reduced" amplitude. If ZANDER's reduced amplitude corresponds to the output per beat, the product should express the output per minute.

According to the procedure used by us a certain doctor determines the blood pressure of the patients at 8 a.m. before they have had breakfast or got up, and at the same time the pulse rate is counted (it must be counted for  $\frac{1}{2}$  or 1 minute). The blood pressure is determined by auscultation (Systolic distinct tone, diastolic rapidly decreasing tone). If e.g. the blood pressure is found to be 130/80, the amplitude is 50. It is multiplied by 100 and divided by the mean of 130 and 80 = 105 ( $5000 : 105 = 48$ ). An examination of "normal" individuals has revealed that the pressure-corrected amplitude mostly is in the vicinity of the above-mentioned figure. A multiplication of this figure by the pulse rate, e.g. 72 gives 3456. Only two ciphers of this figure are used 35 (increased). This is the normal amount of what is termed the *Zander figure* in this paper. In a large number of healthy persons or persons with lesions irrelevant to the blood pressure, e.g. hernia, the Zander figure averages 35 as mentioned. The figures are perhaps somewhat high, it not being a question of quite healthy subjects. Investigating two groups of employees of the Mental Hospitals of Nykøbing S. and Viborg consisting of 114 and 100 persons respectively, YDE and BULOW-JOHANSEN arrived at the average figure of 34. The difference, however, is insignificant.

In case of thyrotoxic lesions the Zander figure is remarkably increased above the normal. The question then is whether there is any correlation between the figures and the extent of the thyrotoxicosis. It being impossible to measure the amount of the poison directly one must content oneself with comparing the Zander figure with the means used at present for indirect measuring the oxygen consumption.

Table 1 A.

*Determination of the reduced amplitude by systolic and diastolic pressure*

		50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	
225							100	94	90	86	81	77	73	69	65	61	57	53	50	46	43	40	225
220							99	93	88	84	79	75	71	67	63	59	54	51	48	44	41	38	220
215							97	92	87	82	77	73	69	65	61	56	52	49	46	42	39	36	215
210						100	95	90	85	80	75	71	67	63	58	54	51	47	44	40	36	33	210
205						98	93	88	83	78	73	69	65	61	56	52	49	45	42	38	34	31	205
200						96	90	86	81	76	71	67	63	58	54	50	46	43	39	36	32	29	200
195					100	94	88	83	79	74	69	65	60	56	52	48	44	40	37	34	30	26	195
190					98	92	86	81	76	72	67	63	58	53	49	46	42	38	34	31	27	23	190
185					97	90	84	79	74	69	65	60	56	51	47	43	39	35	32	28	24	20	185
180				100	95	88	82	77	72	67	63	58	53	49	44	40	36	33	29	25	21	17	180
175				98	92	85	80	74	70	65	60	55	50	46	41	37	34	30	26	22	18	15	175
170					96	89	83	78	72	67	62	58	53	48	43	38	35	31	27	23	19	15	170
165					100	93	86	80	76	70	65	60	55	50	45	40	36	32	28	24	20	16	165
160					98	91	83	78	73	67	62	57	52	47	42	37	33	29	25	20	17	13	160
155					95	88	80	76	70	64	59	53	48	43	39	34	30	26	21	17	13	10	155
150					100	93	86	78	73	67	61	56	50	45	40	35	31	27	22	18	14	10	150
145					98	90	83	75	70	64	58	53	47	42	37	32	28	23	19	15	11	7	145
140					94	87	80	73	67	61	55	49	43	38	33	29	24	20	15	11	7	4	140
135					92	84	77	70	64	57	51	46	40	35	30	25	21	16	12	7	4	0	135
130					89	81	74	67	60	54	48	42	36	31	26	21	17	12	8	4	0		130
125					86	78	70	63	56	50	44	38	33	27	22	17	13	8	4	0			125
120					82	74	67	59	52	46	40	33	29	23	18	13	8	4	0				120
115					79	71	63	56	48	42	36	30	25	19	14	9	4	0					115
110					76	67	59	52	44	38	32	26	20	15	9	5	0						110
105					71	63	55	47	40	34	27	21	16	10	5	0							105
100					67	58	50	43	35	29	22	16	10	5	0								100
95					62	53	45	38	30	24	17	11	5	0									95
90					57	49	40	32	25	19	13	6	0										90
85					52	43	35	27	19	13	5	0											85
80					46	37	29	21	13	5	0												80
		50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	

Systolic pressure

Diastolic pressure

Along the abscissa the Zander figures are set down and along the ordinate the metabolism in percentage of the normal, determined by the KROGH apparatus. The figures in the various columns designate the number of examinations that have revealed the corresponding figures. The examinations were performed with the metabolimeter of the Department, not only in case of struma, but in other diseases as well. The determinations of the Zander figure and the oxygen consumption have been arrived at by single tests. It appears from the table that the Zander figure rises with

Table 1 B

*Determination of the Zander figure by pulse and reduced amplitude*

	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	
185	9	19	28	37	46	56	65	74	83	93	103	112	121	130	139	148	158	167	176	185
180	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	162	171	180
175	9	18	27	35	44	53	61	70	79	88	96	104	114	123	131	140	149	158	167	175
170	9	17	26	34	43	51	60	68	76	85	93	102	110	119	127	136	145	153	163	170
165	8	17	25	33	41	50	58	66	74	83	90	98	107	115	123	132	141	149	157	165
160	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160
155	8	16	24	31	39	47	54	62	70	78	85	93	100	108	116	124	132	139	148	155
150	8	15	23	30	38	45	53	60	68	75	83	90	97	105	113	120	127	136	143	150
145	7	15	22	29	36	44	51	58	65	73	80	87	94	102	109	116	123	130	138	145
140	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140
135	7	14	21	27	34	41	47	54	61	68	74	81	87	94	100	108	116	122	128	135
130	7	13	20	26	33	39	46	52	59	65	72	78	84	91	97	104	110	117	123	130
125	6	13	19	25	31	38	44	50	56	63	69	75	82	87	94	100	107	113	120	125
120	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
115	6	12	18	23	29	35	40	46	52	58	63	69	75	81	86	92	98	104	109	115
110	6	11	17	22	28	33	39	44	50	55	61	66	72	77	83	88	94	99	105	110
105	5	11	16	21	26	32	37	42	47	53	58	63	68	74	79	84	89	95	100	105
100	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
95	5	10	15	19	24	29	33	38	43	48	52	57	62	67	71	76	81	86	90	95
90	5	9	14	18	23	27	32	36	41	45	50	54	59	63	68	72	77	81	86	90
85	4	9	13	17	21	26	30	34	38	43	47	51	55	60	64	68	72	76	81	85
80	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
75	4	8	11	15	19	23	26	30	34	38	41	45	48	53	56	60	64	68	71	75
70	4	7	11	14	18	21	25	28	32	35	39	42	46	49	53	56	60	63	67	70
65	3	7	10	13	16	20	23	26	30	33	36	39	42	46	49	52	55	59	62	65
60	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
55	3	6	9	11	14	17	19	22	25	28	30	33	36	39	42	44	47	50	53	55
50	3	5	8	10	13	15	18	20	23	25	28	30	33	35	38	40	43	45	48	50
45	2	5	7	9	11	14	16	18	21	23	25	27	29	32	34	36	38	41	43	45
40	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	

Reduced amplitude

the metabolism The coefficient of correlation is 0.7, i.e. quite significant The calculation of the regression equation shows  $\text{Metabolism} = 2.5 \times \text{the Zander figure} + 13.33$  That means that a rise of 10 of the Zander figure corresponds to a rise in the metabolism of 25 per cent A metabolism of 100 corresponds to a Zander figure of 34.7 (which corresponds to the above-mentioned empiric figure) A metabolism of 125 corresponds to a Zander figure of 44.7, etc Fig 1 presents a survey of the mutual relation of the figures

Now, the individual cases in the above survey must not be taken too literally In the first place there will be variations which may become quite considerable, neither the metabolic test nor the Zander figure giving an exact picture of the thyrotoxicosis. One must be particularly careful in dealing with the extremes It is the



Table 2

Zander figures	Metabolism percentage												
	60— 70	70— 80	80— 90	90— 100	100— 110	110— 120	120— 130	130— 140	140— 150	150— 160	160— 170	170— 180	180— 190
105—110	—	—	—	—	—	—	—	—	—	—	—	1	—
100—105	—	—	—	—	—	—	—	—	—	—	—	1	—
95—100	—	—	—	—	—	—	—	—	—	—	—	—	—
90—95	—	—	—	—	—	—	—	—	—	—	—	—	—
85—90	—	—	—	—	—	—	—	—	—	1	—	1	—
80—85	—	—	—	—	—	—	—	—	—	—	—	—	—
75—80	—	—	—	—	—	—	—	—	1	1	—	—	—
70—75	—	—	—	—	—	—	—	—	—	—	—	1	—
65—70	—	—	—	—	—	—	—	—	—	1	1	—	—
60—65	—	—	—	—	—	—	—	—	1	1	—	—	—
55—60	—	—	—	—	—	—	4	2	—	1	—	1	1
50—55	—	—	—	1	—	—	2	5	3	1	—	1	—
45—50	—	—	—	2	4	2	3	1	5	2	2	—	—
40—45	—	1	1	3	6	5	4	4	1	—	—	1	—
35—40	—	—	2	10	7	4	5	2	1	—	—	—	—
30—35	—	—	6	13	7	6	2	—	—	—	—	—	—
25—30	1	2	8	8	6	5	1	—	—	—	—	—	—
20—25	1	—	2	4	3	1	—	—	—	—	—	—	—
< 20	—	—	—	1	1	1	—	—	—	—	—	—	—

usual statistical rule not to go beyond the figures on which the calculation is based. Various things indicate that conditions change in case of high Zander figures. Not infrequently one encounters figures of 90—100, even more. But it is probably not justifiable to conclude that the metabolic figure therefore must be above 200. In other words, at a certain limit (about 70) the Zander figure rises more rapidly than the metabolic value. If the Zander figure expresses the output per minute this means that in case of high metabolic values the cardiac activity increases relatively more.

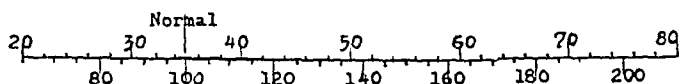


Fig 1

This seems not improbable. In his book GROLLMANN mentions some investigations which directly suggest it. I quite agree with his explanation. One of the most important functions of the blood is to supply the organism with oxygen, but it has other functions as well, e.g. the renal function, and the heat regulation of the skin. Maybe normally these functions are subordinate, but especially in case of Graves' disease they may assume some importance. This

especially is true of the heat regulation. It is a peculiarity of patients suffering from Graves' disease that despite the greatly increased metabolism, the body temperature is not elevated at all or quite inconsiderably. The heat production being greatly increased, the heat loss must have risen to the same extent. When the rectal temperature (the blood temperature) is constant, the heat loss is quite predominantly dependent on the temperature of the skin which again is dependent on the amount of blood flowing through. The fact is that if the temperature of the skin lies close to the blood temperature, e.g. 36.5 centigrade, a far, far larger amount of blood is required to raise it by  $\frac{1}{2}$  degree than if it were e.g. 32.5 (for details see IPSEN Hauttemperaturen). But that again means that in case of the large increases in the metabolism, the heart must not only supply the amount of blood corresponding to the increased metabolism (the oxygen emission per unit of blood quantity hardly increasing particularly), but besides pump a far larger, and in case of high metabolism, rapidly increasing amount of blood through the skin. This quantity of blood must entail an increased cardiac output. It is not surprising, therefore, that the cardiac output increases so rapidly. The heart must supply more blood, not only in order to satisfy the demand for oxygen on account of the increased metabolism, but also in order to eliminate the heat by a more rapid circulation through the skin.

It appeared from table 2 that a certain correlation exists between the metabolic values and the Zander figures. But the correlation is not complete. One of the reasons may be that both methods are subject to "accidental" (i.e. unexplained) variations. Possibly there would be better agreement, if the accidental variations could be eliminated or diminished by taking the mean value of more of them. This, however, would be met with difficulties as far as the metabolic test is concerned. It would mean heavily increased work to carry through series of e.g. daily metabolic tests, and besides it would be very unpleasant for the subject. One must therefore content oneself with single or maybe double examinations made on two consecutive days. As a rule such double examinations show quite good agreement, but may reveal inexplicably great differences. This fact alone is enough to entitle to the conclusion that the reliability of the metabolic examinations must be accepted with certain reservations, variations of 15 per cent up and down (more in case of high metabolism) not being uncommon.

Serial examinations of metabolic values are hardly practicable, but daily determinations of blood pressure and counting of the pulse rate are easily manageable. The latter are therefore quite well suited for the calculation of mean values, provided the condition of the patient has been fairly constant. The condition of patients suffering from Graves' disease is, however, rather labile and may be altered at quite short notice. Such a change in the extent of the thyrotoxicosis affects the metabolic percentage as well as the Zander figure. This disturbance cannot, however, be classed with the "accidental" variations. It is evident that if the patient has settled down after a fortnight's treatment, both metabolic value and Zander figure must decrease considerably, and the figures within the period will of course reveal great variations. On the other hand the patient's condition must be expected to be comparatively unchanged during 3—4 days, and the variations during this period probably mostly belong to the "accidental" variations (compare Fig 2 and pag 59).

In order to investigate whether there is a closer correlation between these mean values and the metabolic values I have taken the average value of 3—4 days in 60 operated patients. These mean values can now be compared with the simultaneous metabolic readings (see Fig 3, I). This gives a better accumulation of the figures, but there is some uncertainty in case of the high values. It is not always possible to decide in the individual case whether a discrepancy is due to the metabolic value being too high or the Zander figure too low.

It would be a good thing to have still another method by which to determine the extent of the thyrotoxicosis. By comparing 3 such methods, it would appear whether one of them was especially divergent from the other two, and therefore improbable. In an earlier paper I have demonstrated that the temperature of the feet, as an expression of the heat loss (see above) may be used for a rough estimation of the kind of the thyrotoxicosis. In Fig 3 I have grouped the methods 2 and 2 (not being able to give a graphic representation of the figures in one diagram) metabolism and Zander figure, metabolism and foot temperature, Zander figure and foot temperature respectively. (The diagrams have been reproduced from a drawing on squared paper with millimetre spacing.)

The metabolic values have been arrived at by single investigation. In 13 cases only did we make double determinations with

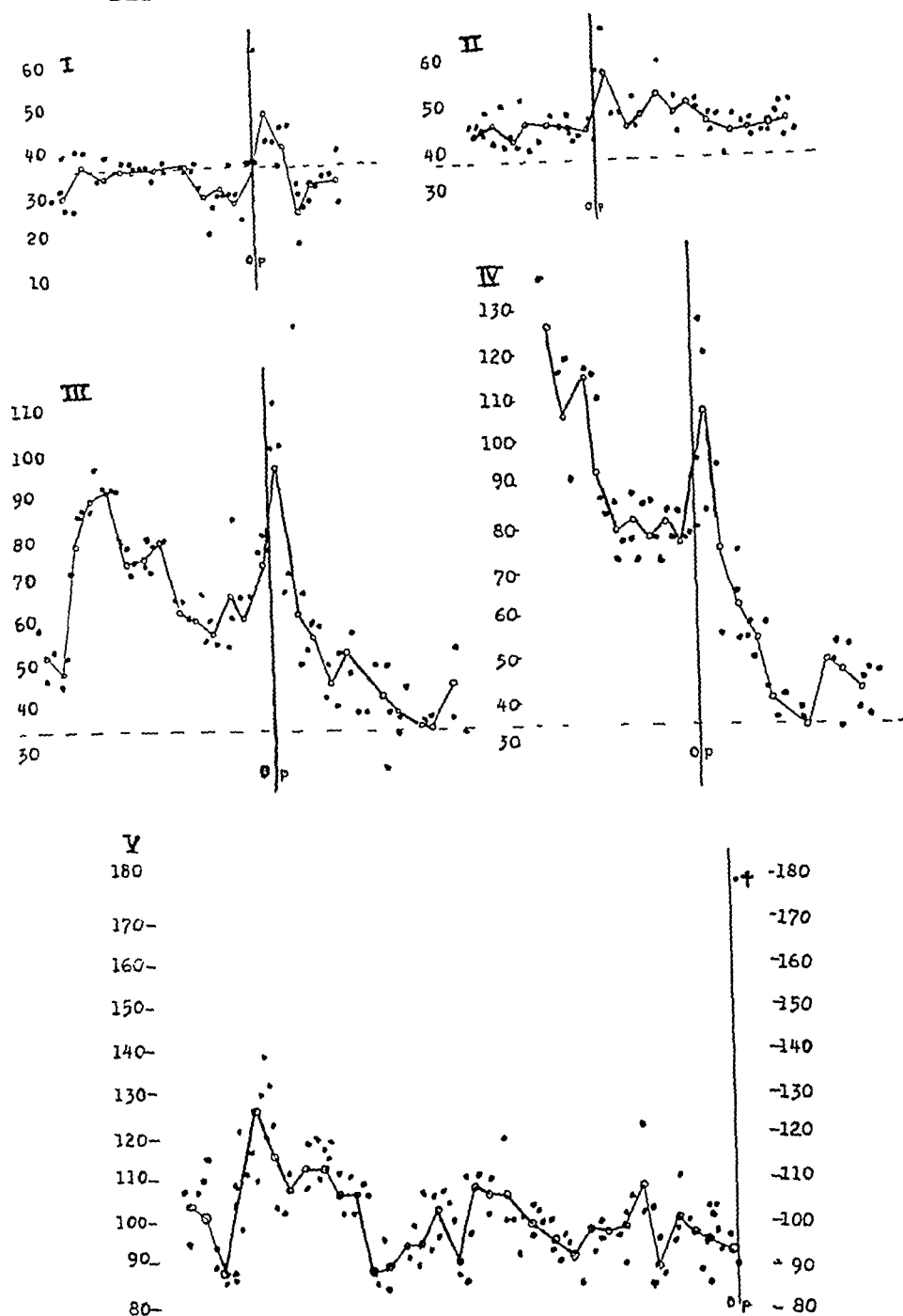
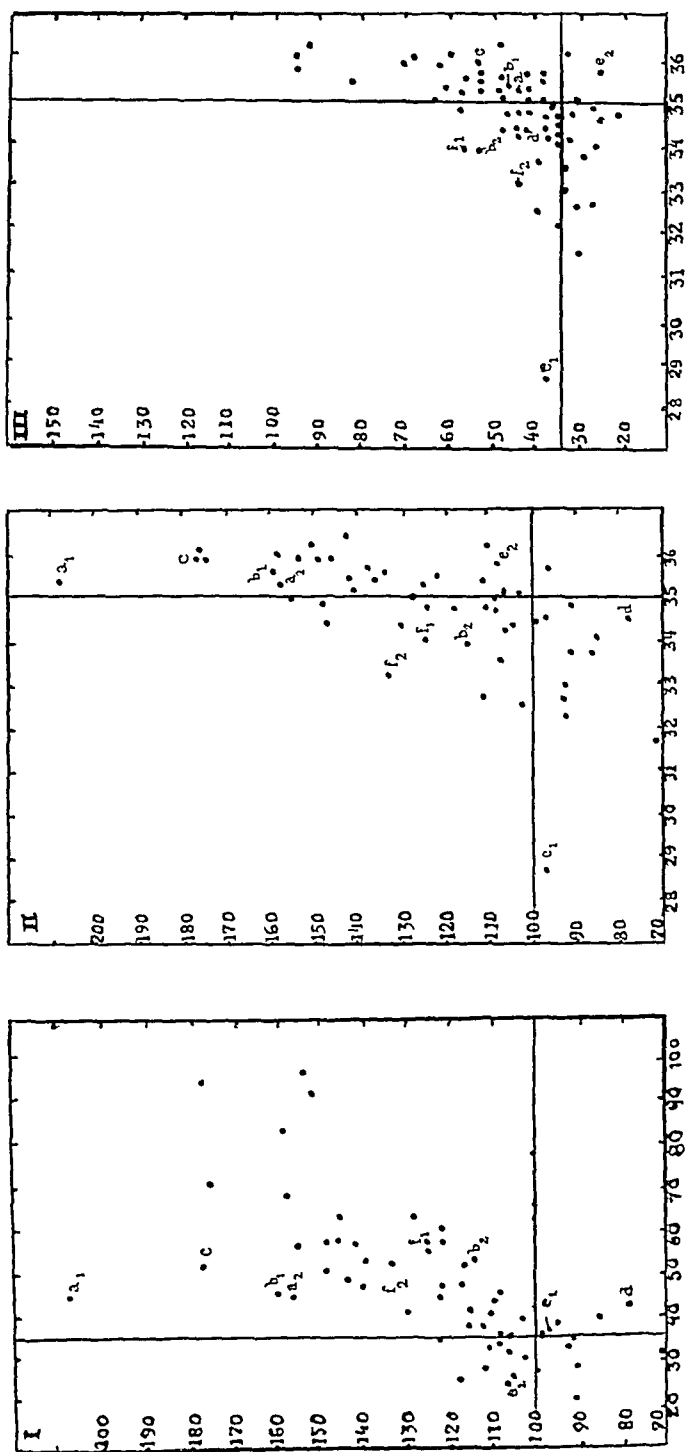


Fig 2

intervals of one or a few days. On the whole they revealed good agreement and their mean value has been used. One case revealed a great difference between the metabolic values, and both figures are recorded (see later).



III Zander figures—Foot temperature

II Metabolism—Foot temperature

I Metabolism—Zander figures

Fig 3

The foot temperature was taken 5 times daily, and the average calculated (day temperature) Further we took the average of 4 consecutive days (level temperatures) The level temperature recorded in the diagrams is that including the date on which the metabolic tests were made The Zander figure is the average of the Zander figures determined within the same 4 days that comprise the level temperature

Upwards there is a height-limit of the foot temperature The rectal temperature (temperature of the blood) of patients suffering from Graves' disease is generally not raised (below 37.5 centigrade) The temperature of the skin being dependent, not only on the amount of blood circulating through (and on the temperature of the blood), but also on the heat loss (radiation, evaporation etc.) it is obvious that the foot temperature in no circumstances can exceed the rectal temperature Actually it never does reach it, because in that case such enormous quantities of blood would have to circulate through the skin that the heart could not stand it In practice level temperatures of above 36.3 centigrade have proved extremely rare when the rectal temperature is normal But this utmost limit (as distinctly apparent from the diagram) involves a greater or less tendency of the curve to an asymptotic climb the further one gets to the right

In the main features the diagrams II and III of Fig. 3 indicate that foot temperatures of above 35° centigrade show a predominant probability of a raised metabolism, whereas foot temperatures of less than 35° imply a normal or only slightly raised metabolism

The comparison of the 3 methods of determination may to some extent help to decide whether the deviation of a single dot is due to an accident or whether the deviation is real Thus diagram I ( $a_1$ ) contains a very high metabolic value (207) corresponding to a Zander figure of 45 The foot temperature is 35.2 centigrade, i.e. corresponding to the transition between normal and raised foot temperatures This indicates a too high metabolism On the following day the metabolism of the same patient showed 157 ( $a_2$ ) This figure fits better, even if it still is rather high to correspond to a Zander figure of 45 and a foot temperature of 35.2 The wrong figure, therefore, probably is 207 Another example ( $b_1$ ) is a metabolic value of 160 and a Zander figure of 44 The patient had a level temperature of 35.3 centigrade, which also is in the transitory stage between normal and raised On the whole this patient's metabolism was very difficult to determine On the following day the metabolism was determined twice giving figures of 149 and 130, which showed considerably better conformity, especially the latter, so presumably the first metabolic value is too high too A fourth time

(b<sub>2</sub>) the same patient had a metabolic value of 115, Zander figure of 54, and a foot temperature of 33.9 (i.e. a too high Zander figure). An electrocardiogram revealed that the patient had a bundle branch block. Whether it has had any effect on her Zander figure I cannot say. Finally there is a metabolic value of 176 (c) with a Zander figure of 53. She had a foot temperature of 35.8, i.e. distinctly raised. It was a woman of 50 whose heart examination had revealed nothing abnormal. It must remain an open question whether the Zander figures have been somewhat low in this case. At any rate, metabolic value as well as foot temperature are high, and the Zander figure in itself is distinctly elevated. Besides, diagram I contains a metabolic value of 79 (d) in connexion with a Zander figure of 43. She had an adenomatous struma with a slightly enhanced Zander figure. On after-examination about 4 months later she had a metabolic value of 101 and 95.5. Everything seems to indicate that it was the metabolic value that was wrong. I may add that her foot temperature was 34.4 or quite normal. I could be tempted to review the diagrams II and III in the same manner, but that would become too extensive. Just let me remark that the only low foot temperature of 28.6 evidently was due to the fact that for some reason or other the patient (e<sub>1</sub>) had arterial spasms at the time. During the same days her metabolic value was 89 and 104 and the Zander figure 38, i.e. both normal. Before the operation she had a foot temperature of 34.1. On the whole her foot temperatures were rather varied. On after-examination she had a metabolic value of 105 and 110, Zander figure of 25 and a foot temperature of 35.7 (e<sub>2</sub>).

Finally, one patient with a metabolic value of 133 and a Zander figure of 45 had a foot temperature of 33.1, and on another occasion a metabolic value of 125, Zander figure of 57, and a foot temperature of 33.1. She too had transitory arterial spasms. Before the operation she had foot temperatures varying between 35.0 and 36.3, Zander figure about 80 and a metabolic value of 175. Regrettably the figures in diagrams II and III stand in such a manner that they obliterate the curved line around which the foot temperatures are ranged.

Apart from these few cases the agreement between the methods is so good that it may be said that the mean of Zander figures taken on 3 to 4 consecutive days gives an equally adequate picture of the thyrotoxicosis as the metabolism. The foot temperatures are perhaps hardly so applicable, even if — broadly speaking — a level temperature of above 35.5 in struma patients indicates a thyrotoxic struma, below 35.0 a slight thyrotoxicosis or none.

The above must sufficiently indicate that by combining these 3 methods of examination the extent of the toxicosis in struma may be more easily determined than by sticking to one method only, e.g. the metabolic test. On the whole the method of taking the mean of 3 Zander figures at any rate seems to be just as reliable as the metabolic test.

In spite of the accidental variations, the Zander figure may yield a good picture of the extent of the thyrotoxicosis in another way, viz by following its course by daily determinations. In the first place it is possible, by observing the Zander figures before the operation, to find a time when the heart action has settled down so as to permit of an operation. As a rough rule it may be stated that if they are not above 70 an operation is warrantable. It is better to wait, if they do not go below. It is true that in the period immediately after the application of the Zander figure determinations began, operations were performed at Zander figures of 70—80 or more, but several of the patients were very exhausted after the operation and the Zander figures rose to more than 100. One single case is recorded on Fig 2 V. It was a woman of 47 with a rather high metabolic value and as appears from the Fig very high Zander figures which had been oscillating about 100 for months. As she gained in weight and on the whole was calm and according to a medical judgment was fit for operation, strum-ectomy was performed. That day the Zander figure kept constant at 90, but on the following day it rose to 179, the highest Zander figure I have ever seen, and she died. Fortunately deaths after operations for Graves' disease are not such a frequent occurrence that one man can gather sufficiently large material, and the death may also be due to other reasons. But still I think that it would be wise to give ear to the warning against operation that the Zander figures may afford.

The Zander figures are also adapted to follow the heart action during operations. In 18 cases determinations have been made during operation. The considerable influence shown by the purely psychic conditions has been successfully recorded. These 18 patients had an average Zander figure of 60.9 in the days before the operation, but on the day of the operation it was 51.8 in the morning. After they were placed on the operating table, but before the operation, there was a violent rise, on an average up to 76.7. This rise must be put down to psychic disturbances alone. In the course of the operation the figures as a rule drop to an average of 67.6.

The Zander figure may also be observed with benefit after the operation. The patients are in a condition which does not allow of metabolic tests, and the foot temperature is not applicable either, because the rectal temperature rises and thereby influences the foot temperature. Especially in these days the Zander figures are of great importance. Roughly it may be said that they are highest



on the 1st and 2nd day after the operation, already on the 3rd day they are decreasing, and during the following weeks the Zander figures drop, so that they are normal as a rule in the 3rd week after the operation. The reaction completely corresponds to the clinical picture. It is lowest in the milder forms of thyrotoxicosis and gradually rises as the symptoms grow more severe. In Fig 4 I shows the mildest forms (Zander figure  $< 40$ ), II the middling forms (41—60), and III the more advanced forms ( $> 61$ ). A is the average of the 3 days before the operation and the mean has again been taken in each of the 3 groups. B is the mean of the

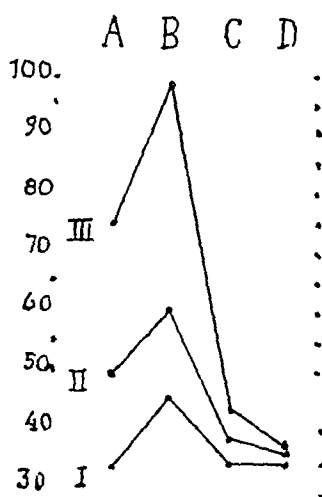


Fig 4

Zander figures the first 3 days after the operation and C indicates the condition on discharge. D is the mean of the Zander figures taken for 3 days on after-examination during which the patient is hospitalized, as a rule 3 months after the operation. The curves show a rather considerable rise on operation. On an average the Zander figures of group III rise as far as 100. Even if the Zander figure only gives a fairly correct picture of the heart action it means that the latter, day and night, performs treble its normal work. In the case of the above-mentioned patient who died the Zander figure rose to 179, i.e. 5 times the normal heart action. It is not surprising that the heart cannot stand the strain. During the reconvalence the Zander figure drops very low. Even the severe cases (above 60 before the operation) return to approximately normal figures. But the average on discharge is above 40 in the

severe cases, on after-examination 3 months later the figures are, however completely normal for all three groups

Out of the 16 severe cases that were operated upon with a Zander figure of more than 60, the one above-mentioned patient died and 11 were admitted for after-examination. Out of these 9 were below 40, 2 had high figures, one 53, and the other 77. The last-mentioned was a typical recurrence, her Zander figure remained unchanged. On discharge 74, on re-admission 73. Evidently the operation has not been extensive enough. She did not want a re-operation. The

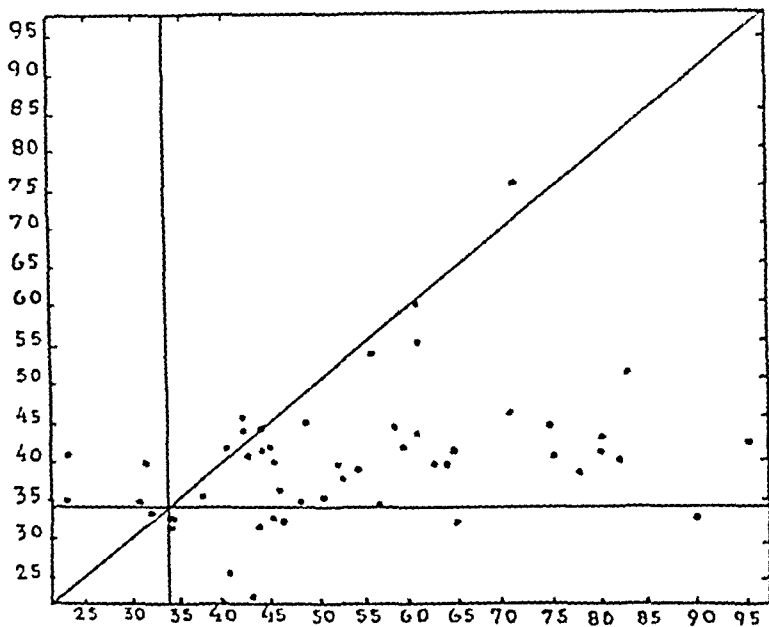


Fig 5

patient with 53 was a woman of 47 who had a colloid adenomatous struma. All in all she had rather severe thyrotoxic symptoms. After the operation she dropped down to 32, but on the last day before discharge she rose to 55. In discharge she had 53 and mild symptoms of recurrence. Possibly new adenomas have developed.

Fig 5 presents a diagram showing all the operative results by comparing the Zander figures before the operation and on discharge. Each dot denotes a patient. The figures along the ordinate are the post-operative, along the abscissa pre-operative readings (average of 3 days). The changes in the individual cases are demonstrated by the vertical intervals between the dots and the oblique line. The dot placed below the oblique line means a drop and above a rise in the Zander figures. The post-operative figures

are somewhat above the normal 35 The highest dot denotes the above-mentioned patient with a recurrence

Fig 2 gives examples of the variations in the Zander figure during the stay in hospital We have picked out patients who have stayed long in the Department The well-marked line connecting a few round circles in the mean of Zander figures within a period of 4 days The individual observations are set off as black dots I and II are the milder cases The curves have only slight oscillations and the dots are not very far from the curve Only in case of violent oscillations as after operations (the vertical line) do the variations in the individual observations become considerable But just in these days the condition of the patient is subject to great changes, so it is not strange that the variation grows larger III and IV represent 2 severe cases, the curves are not so regular, and the dots are farther removed from the curve, especially where the condition changes, so that the dots are not only influenced by accidental variations Lastly, curve V represents the above-mentioned patient who died The Zander figures move about 90—100 with comparatively slight variations

### Summary.

Investigations have been made comparing the metabolic value in Graves' disease and the product of Zander's reduced amplitude and the pulse rate The first two ciphers of this product are termed the Zander figure There is a coefficient of correlation of 0.7 between the Zander figures and the metabolic determinations Both methods are subject to some uncertainty As regards the Zander figures a better result may be obtained by calculating the average of the mean figure for 3—4 days Further, comparisons have been made with the temperature of the skin on the feet, which method, however, is less accurate The determination of the Zander figure is more simple and may be effected under circumstances which do not permit of determining the metabolic value, e.g. during and immediately after operations The Zander figures roughly give an equally good picture of the pre- and post-operative thyrotoxicosis, so that it is possible to observe the variations in the thyrotoxicosis by daily readings of the pulse pressure and the pulse rate The author recommends the use of this simple method, partly to control the metabolic determinations, and partly in

circumstances where the latter are inapplicable, e g on account of lacking apparatus or during and after operations The method can also be applied in private houses

### Zusammenfassung.

Vergleichende Untersuchungen sind vorgenommen worden zwischen den Grundumsatzwerten bei Morbus Basedow und dem Produkt der Zander'schen reduzierten Amplitude und der Pulszahl Die ersten zwei Ziffern dieses Produktes werden als Zanderwert bezeichnet Es stellt sich heraus, dass zwischen den Zanderwerten und den Grundumsatzzahlen ein Korrelationsquotient von 0.7 besteht Beide Methoden sind mit einer gewissen Unsicherheit behaftet Inbezug auf die Zanderwerte kommt man zu einem besseren Ergebnis, wenn man mit dem Mittelwert von Bestimmungen an 3—4 Tagen rechnet Feiner wurden Vergleiche der Hauttemperaturen an den Füssen angestellt, doch ist diese letztgenannte Methode etwas grober Die Untersuchung der Zanderwerte ist einfacher und kann unter Verhältnissen vorgenommen werden, wo sich der Grundumsatz nicht bestimmen lässt, z B während und gleich nach einer Operation Die Zanderwerte geben schätzungsweise ein ebenso gutes Bild von der Thyreotoxikose sowohl vor als auch nach der Operation, so dass man durch tägliche Bestimmungen des Pulsdruckes und der Pulszahl imstande ist, die Schwankungen der Thyreotoxikose zu verfolgen Es wird deshalb dazu geraten, diese einfache Methode auszuführen, erstens als Kontrolle der Grundumsatzuntersuchungen und zweitens, wenn letztere nicht vorgenommen werden können, z B wegen Mangels an Apparatur oder während und nach einer Operation Die Methode ist auch im Privathause verwendbar

### Résumé.

L'auteur a fait des recherches parallèles pour comparer le métabolisme dans la maladie de Basedow au produit de la diminution d'amplitude de Zander et du chiffre du pouls Les deux premiers chiffres de ce produits sont appelés «chiffres de Zander» Il a constaté qu'il existe un quotient de corrélation de 0.7 entre les chiffres de Zander et les évaluations du métabolisme Les deux méthodes sont grevées d'une certaine incertitude En

ce qui concerne les chiffres de Zander on peut obtenir un meilleur résultat en portant de la moyenne des chiffres moyens trouvés pendant 3—4 jours. En outre il a entrepris de comparer les températures cutanées des pieds, mais cette dernière méthode est passablement plus grossière. Les examens basés sur les chiffres de Zander sont plus simples et peuvent se faire dans des circonstances où le métabolisme ne saurait être mesuré, par exemple pendant et juste après l'opération. Les chiffres de Zander donnent, au jugé, une image juste aussi bonne de la thyrotoxicose tant avant qu'après l'opération, en ce sens que si l'on prend chaque jour la pression artérielle et le pouls on est à même de suivre les fluctuations de la thyrotoxicose. De la sorte il est recommandé d'appliquer cette méthode simple soit pour contrôler les déterminations du métabolisme, soit pour les remplacer lorsqu'elles ne sont pas possibles, par exemple quand l'appareillage fait défaut, ou encore pendant et après l'opération. La méthode est également applicable à domicile.

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## Einige Erfahrungen über zehnjährige Anwendung von Evipannarkose.<sup>1</sup>

Von

ANDERS WESTERBORN

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Im Sommer 1932 wurden die ersten Evipanampullen zur Prüfung an einige deutsche chirurgische Kliniken versandt, und im Herbst desselben Jahres sah ich bei einem Besuch bei MAGNUS in Bochum zum erstenmal eine intravenöse Narkose. Seit dem April 1933 stand Evipan in Schweden zur Verfügung, und ich begann sofort mit intravenösen Narkosen, diese habe ich dann in immer grösserem Umfang gegeben und die ganze Zeit über Evipan verwendet. Da es also jetzt 10 Jahre her ist, seit die erste Evipannarkose bei uns in Schweden gegeben wurde, glaube ich, dass eine kurze Übersicht über die wichtigsten Erfahrungen von allgemeinem Interesse sein dürfte.

In den ersten Jahren war Evipan das einzige intravenöse Narkosemittel, aber im Lauf der Jahre sind eine Reihe andere hinzugekommen, welche alle das gemeinsam haben, dass sie Derivate von Barbitursäure und von ziemlich gleichartiger Wirkung sind. Das Evipan hat jedoch, wenigstens in Europa, seine dominierende Stellung behalten, und der Verbrauch zeigt, wie mir die Firma mitgeteilt hat, eine ständig steigende Kurve. Man hat auch meines Wissens kein Mittel mit grösserer Narkosenbreite hergestellt als Evipan. In Amerika, wo die intravenöse Narkose sehr populär ist, verwendet man sowohl Evipan als Pentolan (Natrium-Athyl-1-Methyl-Buthyl-Barbitursäure). Das letztere verdient nach ADAMS den Vorzug, weil es besseren Schlaf in kleinerer Dosis gibt. In Schweden benutzt man in grossem Umfang das schwedische Mittel Narkotal, welches dasselbe ist wie das deutsche Eunarcon. Da es keine Vorzüge vor Evipan, aber geringere

<sup>1</sup> Vortrag in der Sitzung des Schwedischen Chirurgenvereins in Göteborg im März 1943

Narkosenbreite hat, habe ich es für am richtigsten gehalten, bei Evipan zu bleiben. Dazu kommt, dass ich ungern ein Mittel aufgeben mochte, mit dem ich mich wohlvertraut gemacht habe, und das sich bei richtiger Dosierung als ungefährlich und sehr wirksam erwiesen hat. Der Preis ist auch ungefähr derselbe wie für Narkotal.

Aus Tab. I geht hervor, in welchem Umfang Evipan in den letzten 10 Jahren auf meinen Abteilungen zur Anwendung gekommen ist (im Krankenhaus in Varberg bis 1939 und dann auf der Chirurgischen Abteilung II des Sahlgrenschen Krankenhauses). Die Anzahl Evipannarkosen ist von 308 im J. 1932 auf 1,589 im vorigen Jahre gestiegen. Schon im Jahre 1934 gab ich nahezu 700 Narkosen. In den folgenden Jahren trat, wie die Tabelle zeigt, ein gewisser Stillstand in der Entwicklung ein, was mit dem Streit über die Berechtigung des Evipans zusammenhängt, der zu jener Zeit bei uns in Schweden im Gang war, in diesem Stillstand kommt vielleicht die Furcht vor Komplikationen zum Ausdruck, welche die damals eingetretenen Todesfälle hervorriefen. Der Evipanverbrauch in Schweden sank fast katastrophal. Bedauerlicherweise horte man nun in vielen Krankenhäusern ganz mit den Evipannarkosen auf, und in mehreren von diesen hat man noch nicht gewagt, diese Narkoseform wieder aufzunehmen. Die weiteren Erfahrungen haben gelehrt, dass diese Furcht unbegründet war, und das Evipan hat seinen Siegeszug durch die Welt fortgesetzt, zum Segen der vielen, die sich einer Operation unterziehen müssen.

Tabelle I

Jahre	Die ganze Anzahl Narkosen	Evipannarkosen einschliesslich mit Evipan kombinierten Anästhesien	Evipannarkosen in %
1933	915	308	33
1934	1,132	699	62
1935	1,127	595	53
1936	1,338	563	42
1937	1,294	571	44
1938	1,303	541	41
1939	1,263	599	48
1940	1,243	740	60
1941	1,354	1,171	86
1942	1,750	1,589	90
Summe	12,696	7,376	58

Die Gesamtzahl der Evipannarkosen auf meinen Abteilungen betragt nach Tab I 7,376 Diese Ziffer bezieht sich auf die gebuchten klinischen Operationen Hierzu kommt eine grosse Anzahl Evipannarkosen bei Zystoskopien, Frakturpositionen und kleineren poliklinischen Eingriffen, so dass in den 10 Jahren uber 8,000 Evipannarkosen gegeben worden sind Der Anteil der intravenosen Narkosen an der Gesamtzahl der Narkosen ist in den 10 Jahren von ca 30 % auf 90 % gestiegen In diesen Zahlen sind auch kombinierte Anasthesien enthalten Wie aus dem Folgenden hervorgeht, bin ich in den letzten Jahren in grossem Umfang zu kombinierten Narkosen ubergegangen Die reinen Evipannarkosen machten 1942 ungefahr 50 % samthlicher Narkosen aus Aus Tab II geht hervor, dass die Evipannarkosen 1932 19 % und 10 Jahre spater 50 % aller Anasthesien betruen

Die Zunahme der Evipannarkosen erfolgte vor allem durch Zuruckdrangung der Athernarkose, die wahrend des genannten Zeitraums von 40 % auf weniger als 10 % abnahm Wie ich fruher wiederholt hervorgehoben habe, ist die Athernarkose meiner Ansicht nach mit so vielen Nachteilen behaftet, dass wenigstens die Abschaffung der reinen Athernarkose ein wunschenswertes Ziel ist, und dieses wird sich dank intravenoser Narkose und Lustgas bald verwirklichen lassen Auf der Chirurgischen Abteilung II des Sahlgrenschen Krankenhauses wurden 1942 nur 51 reine Athernarkosen und in weiteren 160 Fallen Athermischnarkose gegeben Die entsprechenden Ziffern fur 1937, also 5 Jahre fruher, sind 380 und 45 Dieselbe Tendenz macht sich auch in einigen anderen schwedischen Krankenhausern, z B dem Karolinschen Krankenhaus, bemerkbar, wo nach GORDH 1940 reine Athernarkose nur bei 15 % aller Operationen stattfand, und diese Ziffer ist seitdem weiterhin gesunken Da in vielen schwedischen Krankenhausern die Athernarkose noch immer beliebt ist, kann ich es nicht unterlassen, erneut auf den grossen Unterschied zwischen intravenoser Narkose und Athernarkose hinzuweisen Bei der ersteren schlummern die Patienten unter dem Bilde grosser Mudigkeit ohne Unruhe und ohne Exzitation ein, bei der letzteren erfolgt das Einschlafen mit Erstickungsgefuhl, Angst und Unruhe, und oft tritt Exzitation ein, bevor Vollnarkose erreicht ist Das Erwachen geschieht im ersteren Fall ohne Erbrechen oder sonstiges Unbehagen, wahrend im letzteren Fall Erbrechen die Regel ist, sowie Uebelkeit, die mehrere Stunden, ja sogar Tage anhalt Beschwerden, an welche die



Patienten oft ihr ganzes Leben lang mit Ekel denken. Bei den intravenösen Narkosen erfolgt das Einschlummern so ruhig und unmerklich, dass die Patienten oft nicht glauben wollen, dass sie geschlafen haben und im Schlaf operiert worden sind. Kollegen, welche mit diesen beiden Narkoseformen operiert wurden, äussern sich einstimmig mit Worten des höchsten Lobes zugunsten der intravenösen Narkosen. *Die Evipannarkose vermindert die Leiden der Kranken, während die Äthernarkose sie steigert.*

Tabelle II

*Die verschiedenen Anästhesieformen in %*

Jahre	Chloralhydrat u. Äther- narkosen	Evipan- u. mit Evipan kombinierten Narkosen	Lokal- anästhesie	Lumbal- anästhesie	Andere Anästhesien
1933	39	19	32	4	6
1934	26	43	29	2	—
1935	32	38	30	—	—
1936	40	29	29	1	1
1937	37	31	30	1	1
1938	40	29	29	1	1
1939	39	36	24	—	1
1940	21	32	38	3	2
1941	8	46	40	3	3
1942	4	50	37	7	2

Lokalanästhesie wurde, wie aus Tab. II hervorgeht, die ganze Zeit über in ungefähr demselben Umfang vorgenommen. Die Ziffer hält sich um 30–40 % sämtlicher Anästhesien. Diese sehr niedrige Zahl erklärt sich daraus, dass wir aus rein humanitären Gründen und auf ausdrücklichen Wunsch der Patienten in vielen Fällen Evipan geben, wo sehr wohl Lokalanästhesie möglich wäre, z. B. bei Bruchoperationen. Dies ist berechtigt, wenn man die intravenöse Technik so beherrscht, dass eine Evipannarkose nicht gefährlicher ist als die Lokalanästhesie. Am Karolinschen Krankenhaus betrug 1940 die Zahl der örtlichen Betäubungen 61,8 %, an den Chirurgischen Kliniken in Upsala und Lund 52 bzw. 41 %.

In den ersten Jahren der intravenösen Narkose suchte man in grossem Umfang, mit Evipan allein Vollnarkose herbeizuführen. Dies ist in vielen Fällen möglich, aber nicht in allen. Es gibt evipanresistente Fälle, und in diesen darf man, wie ich früher hervorgehoben habe, nicht versuchen, Vollnarkose zu erzwingen, weil man dann Überdosierung riskiert. Die meisten Komplika-

tionen in der ersten Zeit des Evipans sind auch auf eine solche Überdosierung zurückzuführen. Man muss in diesen Fällen bald zu einem andern Narkosemittel übergehen und Evipan nur als Basisnarkose anwenden. Ich habe es mir deshalb zur Regel gemacht, die Narkose niemals mit Evipan allein fortzusetzen, wenn nicht Vollnarkose bei 10 ccm eintritt.

Tabelle III

*Anzahl Fälle von reinen Evipannarkosen und Evipannarkosen kombiniert mit anderen Betäubungsformen während der Jahre 1933—1942*

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	Summe
Evipan	241	663	531	465	422	410	420	544	564	839	5,102
» + Chloräthyl	14	8	8	6	18	13	39	10	8	15	139
» + Chloräthyl + Äther	44	22	51	80	99	87	123	72	37	58	673
» + N <sub>2</sub> O + O <sub>2</sub>	—	—	—	—	—	—	—	87	484	548	1,119
» N <sub>2</sub> O + O <sub>2</sub> + Äther	—	—	—	—	—	—	—	3	46	71	120
» + Lokalanästhesie	6	6	5	12	32	31	17	16	22	22	169
» 1/2 Lumbalanästhesie	—	—	—	—	—	—	—	8	10	36	54
Summe	308	699	595	563	571	541	599	740	1,171	1,589	7,376

Wie aus Tab. III ersichtlich ist, haben wir auch in den letzten Jahren in sehr grossem Umfang kombinierte Narkosen gegeben. Die Anzahl derselben ist in den letzten drei Jahren mehr gestiegen als die der reinen Evipannarkosen. Vor allem fand ich die Kombination von Evipan und Lustgas in vielen Beziehungen ideal. Diese beiden Mittel erzeugen ohne Zusatz von Äther einen für die meisten Operationen genügend tiefen und langen Schlaf. Im vorigen Jahre wurden nicht weniger als 619 solche Narkosen gegeben. Nur in 71 Fällen, d. h. 13 % (Tab. IV), mussten wir kleinere Mengen Äther, im allgemeinen einige wenige Kubikzentimeter, zusetzen. Diese Narkosekombination ist in den letzten Jahren von mehreren Seiten empfohlen worden. LUNDY und ADAMS von der Mayo-Klinik, FRUND, GORDH und STORTEBECKER, welcher letzterer in den *Acta chirurgica scandinavica* 1941 im einzelnen über unsere hundert ersten Fälle berichtet hat, FRUND, der früh für diese Kombination eingetreten ist, sagt, dass sie sich dem Ideal einer Narkose annähert, ein Urteil, dem ich durchaus beistimmen kann. Die Evipan-Lustgas-Narkose

schont die Psyche und bewirkt wie das Evipan angenehmes Einschlummern, ruhigen Schlaf und rasches Erwachen ohne irgendwelches Unbehagen. Es ist erstaunlich, wie wenig die Patienten nach diesen Narkosen angegriffen sind. Die postnarkotischen Unruhezustände, die in den ersten Jahren des Evipans häufig vorkamen, gehören nach der Lustgas-Evipan-Narkose zu den Seltenheiten und nehmen niemals hochgradige Form an. Auch nach der reinen Evipannarkose erleben wir ausserst selten Unruhezustände. Wie ich früher hervorgehoben habe, ist dies meiner Ansicht nach grossenteils der Piamedikation mit Morphin zuzuschreiben, für die ich von Anfang an eingetreten bin, obgleich man in einem frühen Stadium der Entwicklung in der Literatur von ihr abgeraten hat, vor allem, weil beide Mittel die Atmungszentren beeinflussten. Jetzt wird die Piamedikation ziemlich einstimmig befürwortet.

Ebenso wie GORDH u. a. bin ich der Ansicht, dass die Piamedikation vor einer längeren Operation von grosser Bedeutung für den Verlauf der Narkose ist. Das Einschlummern erfolgt rascher, der Schlaf ist ruhiger, und man verbraucht weniger Narkosemittel. Wir geben im allgemeinen  $1\frac{1}{2}$  cg Morphin oder, bei jüngeren Männern, Scopolal (Morphin, Scopolamin, Ephedrin) nach KIRSCHNER. Von grösster Wichtigkeit ist, dass die Injektion genügend lange ( $\frac{1}{2}$ —1 Stunde) vor Beginn der Operation stattfindet, so dass volle Wirkung erzielt wird, bevor man mit der Narkose beginnt.

Ich habe entschieden den Eindruck, dass Lustgas die Wirkung des Evipans auf die Atmungszentren abschwächt. Die während der Evipannarkose oberflächliche Atmung wird tiefer, sobald Lustgas zugesetzt wird. Ferner haben wir die Möglichkeit, mit Hilfe des Sauerstoffs und der Kohlensäure des Apparats die Atmung zu beeinflussen und zu regulieren, falls dies erforderlich sein sollte. Bei dieser Narkose treten weder Blutdrucksenkung noch vasomotorische Störungen ein, weshalb die Schockgefahr gering ist. Evipan setzt den Lustgasverbrauch, wie STORTEBECKER nachgewiesen hat, erheblich herab, was finanziell von Bedeutung ist. Nach GORDH (Svenska läkaretidningen 1941) sind die kombinierten Narkosen billiger als die Äthernarkose, die Kosten belaufen sich auf ca. 3 Kronen je Stunde.

Die Evipannarkose ist auf der Chirurgischen Abteilung II des Sahlgrenschen Krankenhauses insofern die Narkose der Wahl (Tabelle IV), als beim Fehlen von Gegenindikationen jede Nar-

Tabelle IV.

*Anesthesien in der chirurgischen Abteilung II des Sahlgrenschen  
Krankenhauses in Gothenburg im Jahre 1942*

	Anzahl Fälle
1 <i>Narkosen</i>	
Evipan	839
» + Ather	15
» + Chlorathyl + Ather	58
» + Lustgas	548
» + » + Ather	71
Ather + Chlorathyl	51
Chlorathyl	76
Lustgas	4
» + Ather	11
	<hr/> Summe 1,673
2 <i>Lokalanesthesien</i>	
Novocain (Athocain)	1,138
» » + Chlorathyl	4
» » + Evipan	22
» » + Lustgas	4
Frierung mit Chlorathyl	10
	<hr/> Summe 1,178
3 <i>Lumbalanesthesien</i>	
Percain (Athocain)	162
» » + Evipan	36
» » + Ather	5
» » + Lustgas	6
	<hr/> Summe 209
4 <i>Avertinnarkosen</i>	45
	<hr/> Summe Anesthesien 3,105

kose mit Evipan eingeleitet wird. Schlaft der Patient bei einer massigen Evipandosis gut und hinreichend tief, so werden wiederholte kleine Evipandosen in gewöhnlicher Weise gegeben. Ist der Schlaf nicht tief genug, so gehen wir zu Lustgas über. Handelt es sich um eine längere Narkose, so führen wir auch während der Lustgasnarkose kleinere Evipanmengen zu, teils um die Narkose zu vertiefen, ohne zu Ather greifen zu müssen, teils um den Lustgasverbrauch einzuschränken und die Narkose zu verbilligen. Die Nadel muss in diesen Fällen die ganze Zeit über in der Vene steckenbleiben, und wir verwenden Olovsons Heparinnadel, die mit einer Gummimembran versehen ist, welche Blutung verhindert. Bei geringem Evipanverbrauch muss man die Nadel hin und wieder mit Kochsalzlosung durchspülen, um Koagulation zu

verhindern — Komplikationen haben wir bei dieser Narkosekombination nicht erlebt, und sie ist sicher noch weniger gefährlich als die reine Evipannarkose

Schon zu Beginn wurde gesagt, dass Evipan zweckmassig mit Chlorathyl und Ather kombiniert werden kann Aus Tab III geht hervor, dass diese Kombinationen noch angewandt werden, wenngleich in geringerem Umfang, nachdem wir einen Lustgasapparat erhalten haben (1940), letzteres in erster Linie, um möglichst vom Ather loszukommen — Intravenöse Narkose wird auch in geeigneten Fällen mit Lokalanästhesie kombiniert Dies vermindert den Evipanverbrauch und ermöglicht Operationen in oberflächlicher Evipannarkose

In den zwei letzten Jahren habe ich auch Evipan im Zusammenhang mit Spinalanästhesie gegeben, und zwar aus mehreren Gründen Der wichtigste ist, dass Patienten bei Bauchoperationen, wo man im übrigen den grossten Nutzen von der Spinalanästhesie hat, oft starke subjektive Beschwerden in Form von Brechreiz und allgemeiner Ubelkeit mit starker Beeinflussung der Psyche haben Gibt man diesen Patienten eine kleine Evipandosis, so bleiben sie von allen diesen Beschwerden verschont und brauchen nicht während einer langen und angreifenden Operation wach zu liegen, und man hat doch die grossen Vorteile der Lumbalanästhesie, vollständige Muskelschlaffheit usw Da die Schmerzempfindungen in diesen Fällen schon ausgeschaltet sind, kann die Narkose sehr oberflächlich sein Ich habe den Eindruck, dass die Blutdrucksenkung bei dieser Kombination geringer ist als bei reiner Spinalanästhesie Seitdem ich hiermit begonnen habe, habe ich die Indikationen für die Spinalanästhesie erweitert (Ich habe mich früher vor Spinalanästhesie gescheut wegen der grossen subjektiven Beschwerden, die sie in vielen Fällen hervorruft) Es ist jedoch notwendig, in diesen Fällen besonders vorsichtig bei der Evipanzufuhr zu sein, da es scheint, als ob die Kombination die Atmungszentren starker beeinflusst als die reine Evipannarkose Wir haben nämlich in zwei Fällen von Ventrikelresektion kurze Atmungsstillstände bekommen, die nach 1—2 Minuten künstlicher Atmung behoben wurden In dem einen Fall wachte der Patient bald auf, aber die Atmungsimpulse fehlten, und die Atmung musste eine Weile dadurch in Gang gehalten werden, dass der Patient wiederholt zum Atmen aufgefordert wurde Meine Erfahrungen mit dieser Kombination sind noch nicht ausreichend für eine sichere Beurteilung der Gefahren Ich

glaube jedoch, dass man bei einer sehr hohen Spinalanästhesie klug tut, nicht gleichzeitig Evipan zu geben. ADAMS von der Mayo-Klinik befürwortet auch diese Anästhesieform, warnt aber vor Überdosierung des intravenösen Mittels.

Was Kontraindikationen betrifft, so ist für mich jetzt nur hochgradiger oder langanhaltender Ikterus mit begleitender schwerer Leberschädigung ein Hindernis für Evipannarkose. In Fällen mit leichtem und kurzem Ikterus leite ich die Lustgasnarkose gern mit einer kleineren Menge Evipan ein. Gewisse andere Krankheiten, z. B. Anämien, Ileus und hochgradige Herabsetzung des Allgemeinzustands, zwingen zu spezieller Vorsicht bei der Dosierung. Einige, z. B. STROMBECK, sind der Ansicht, dass Evipan bei Diabetespatienten wegen verlangsamter Ausscheidung durch die Leber gegenindiziert ist. Bei über hundert grösseren oder kleineren Operationen an Diabetespatienten habe ich Evipannarkose gegeben und dabei nur günstige Erfahrungen gemacht. Einen schädlichen Einfluss auf den Blutzucker oder den Stoffwechsel im übrigen habe ich nicht beobachtet, und ich gehe so weit zu behaupten, dass die Evipannarkose speziell geeignet für Patienten mit Diabetes ist.

Meine früheren Erfahrungen, dass die Komplikationen bei einer lege artis ausgeführten Evipannarkose weniger zahlreich sind als bei anderen Narkoseformen (Svenska Lakartidningen 1938), haben sich im Lauf der Jahre bestätigt. Früher, als wir grössere Evipanmengen verwendeten, kam es nicht selten vor, dass die Atmung beeinflusst und zu oberflächlich wurde, und in einigen Fällen traten auch kürzere Atmungsstillstände auf. Seitdem wir es aber vermeiden, in resistenten Fällen Vollnarkose mit Evipan allein zu erzwingen, sondern die Narkose mit Lustgas fortsetzen, sehen wir niemals bedrohliche Erscheinungen. So vertieft sich, wie schon bemerkt, eine oberflächliche Atmung sofort bei Zufuhr von Lustgas. — Während meiner Tätigkeit in Varberg trat ein Todesfall ein, der mit der Evipannarkose in Zusammenhang gebracht werden kann. Ein 80-jähriger Mann mit rezidivierendem Kanzer in Zunge und Mundboden starb unter Elektrokoagulation an Herzstillstand. Der schwere, angreifende Eingriff allein kann bei diesem alten Mann den letalen Ausgang verursacht haben, aber das Evipan kann nicht ganz freigesprochen werden. Anfanglich hat man auch vor Evipan bei Mundbodenoperationen gewarnt. Ich habe es indes bei vielen solchen Eingriffen ohne irgendwelche bedrohliche Erscheinungen ange-

wandt — Lungen- und Herzkomplicationen sind bei uns immer sehr selten nach den Evipannarkosen

Eine perfekte intravenöse Narkose erfordert recht lange Übung, vor allem Erfahrung bei Beurteilung der Atmung. Deshalb ist es von grossem Vorteil, dass man eine gut geschulte Narkoseschwester hat. Technisch kann die Einführung und das Festhalten der Nadel in Fällen, wo die Kubitalvenen klein sind oder tief liegen, die grossten Schwierigkeiten bereiten. Die Patienten, denen wir wegen dieser Schwierigkeiten kein Evipan geben konnten, sind sehr gering an Zahl. Natürlich ist es nicht zu vermeiden, dass die Injektion gelegentlich paravenös erfolgt. In diesen Fällen tritt kein Schlaf ein oder erst sehr spät. Ernste Schädigungen, z. B. Hautnekrose, habe ich nicht gesehen. Thrombophlebitis in der Vena cubitalis nach einer Evipanjektion kann vorkommen, ist aber im allgemeinen gut begrenzt und verursacht keine grossen Beschwerden.

ERHARDT und KNEIP und neulich JUNGHANNS haben die intrasternale Evipan-Narkose rekommen diert (Zbl. f. Chir. 1943 S. 931). JUNGHANNS sagt »Das Verfahren ist einfach und bei richtiger Durchführung der nicht schwierigen Technik gefahrlos«. Die intrasternale Injektion kommt in Frage, wenn die intravenöse Injektion unmöglich ist oder grosse Schwierigkeiten bereitet, z. B. bei Kranken mit schlechten Venen, bei Verödung der üblichen Armvenen durch zahlreichen intravenösen Einspritzungen bei Verbrennungen, Entzündungen oder Hautkrankheiten beider Arme. Bisher musste in diesen Fällen auf Anwendung einer intravenösen Narkose verzichtet werden und Inhalationsnarkose gegeben. Durch Anwendung intrasternaler Injektion lässt sich jetzt also auch für diese Kranken die Inhalationsnarkose ersetzen.

In der Literatur findet man gegenwärtig sehr wenig über die intravenösen Narkosen. Dies ist, wie ich glaube, so zu deuten, dass, nachdem man genügende Erfahrungen mit dieser Narkoseform gesammelt hat, selten Komplikationen eintreten, und dass die Stellung der intravenösen Narkose in der Medizin jetzt gesichert ist. Spezielle Fortschritte oder Veränderungen in den letzten Jahren sind auch nicht zu verzeichnen. Bei Behandlung von Kriegsverletzten ist Evipannarkose in sehr grossem Umfang zur Anwendung gekommen und hat sich den alten Narkoseformen in vieler Beziehung als überlegen erwiesen, vor allem durch ihre Einfachheit. Ich selbst hatte während meiner Arbeit in Finn-

land den allergrossten Nutzen von Evipan. Im zivilen Leben eignet es sich am wenigsten für junge Männer, aber im Kriege scheinen die Verhältnisse etwas anders zu liegen. So gut wie jeder Patient schlief hinreichend lange bei einer massigen Evipandosis. Es handelt sich ja auch im allgemeinen um stark mitgenommene und ermudete Patienten, bei denen schon die Pramedikation sehr abstumpfend wirkt.

*Mein allgemeines Urteil über die intravenösen Narkosen nach einer zehnjährigen Erfahrung und 8,000 Narkosen ist, dass sie die Hoffnungen durchaus erfüllt haben, die man von Anfang an auf sie gesetzt hat. Da bei der intravenösen Narkose das Einschlummern, der Schlaf und das Erwachen in hohem Grade den Verhältnissen beim natürlichen Schlaf gleichen, sind die Patienten sehr zufrieden mit ihr. Keiner meiner Tausende von Patienten hat sie als unangenehm empfunden. Ich kann es deshalb nur bedauern, dass diese Narkoseform nicht die Anwendung in unseren Krankenhäusern gefunden hat, welche sie verdient. Besonders sind die Kombinationsnarkosen zu empfehlen, die in grossem Umfang auf meiner Abteilung vorgenommen worden sind. Ich kann deshalb nicht umhin, im Interesse der Kranken und der Ärzte selbst die Kollegen, die bisher keine intravenöse Narkose gegeben haben, aufzufordern, sich mit dieser Narkoseform vertraut zu machen. Wer einmal mit intravenöser Narkose begonnen hat, kann sich dann kaum mehr die Möglichkeit denken, ohne sie auszukommen.*

### Zusammenfassung.

Die intravenöse Narkose ist jetzt 10 Jahre alt. Sie ist in ständigem Vordringen und verdrängt glücklicherweise mehr und mehr die Äthernarkosen. Evipan ist noch immer in Europa das dominierende Narkosemittel. Auf den Abteilungen des Verfassers sind in den Jahren 1933—1942 über 8,000 Evipannarkosen gegeben worden. Ihr Anteil an der Gesamtzahl aller Narkosen ist während dieser Zeit von 30 auf 90 % gestiegen, während die Zahl der Äthernarkosen von 40 auf weniger als 10 % gesunken ist. Die Lokalanästhesien weisen prozentual keine Veränderung auf.

Auf der Chirurgischen Abteilung II des Sahlgrenschen Krankenhauses wurden im letzten Jahr 1,673 Narkosen vorgenommen, davon 839 reine und 692 kombinierte Evipannarkosen,



nur 51 reine Ather- und 160 Athermischnarkosen. In resistenten Fällen darf man nicht durch Erhöhung der Evipanmenge Vollnarkose zu erzwingen versuchen, sondern muss zu Mischnarkose übergehen, am besten zu Evipan-Lustgas. Diese Narkoseform wird warm empfohlen. Bei langen Operationen wird die Narkose mit Evipan eingeleitet, und dann werden unter Lustgaszufuhr wiederholte kleine Mengen Evipan gegeben. Das Lustgas schwächt den Einfluss des Evipans auf die Atmungszentren ab. Prämedikation mit Morphinum oder Scopodal ist von Bedeutung für den Verlauf der Narkose. — Die Spinalanästhesie kann auch erforderlichenfalls durch eine oberflächliche Evipannarkose ergänzt werden.

Die einzige absolute Kontraindikation gegen Evipannarkose ist langer Ikterus. Bei Diabetes ist Evipannarkose eine sehr geeignete Betaubungsform. Sie ist bei perfekter Technik ungefährlich, und Komplikationen sind jetzt ausserst selten.

### Summary.

Intravenous anesthesia has now been in use for ten years. It is gaining ground steadily and fortunately is coming more and more to replace ether narcosis. Evipan is still the principal anesthetic. Between 1933 and 1942 the writer produced anesthesia with evipan in 8000 cases. The ratio of patients anesthetized with evipan to those anesthetized with all other drugs rose from 30 per cent to 90 per cent during that period, while the ratio of patients anesthetized with ether dropped from 40 per cent to less than 10 per cent. Local anesthesia shows no percentual change.

In the Second Surgical Service of Sahlgrenska Sjukhuset 1,673 cases were given intravenous narcosis last year, combined evipan was given in 692 of these cases and pure in 839. Pure ether anesthesia was given in 51 cases and mixed ether in 160 cases. In refractory cases one should not attempt to force complete narcosis by increasing the quantity of evipan, but should instead resort to mixed anesthesia, preferably with evipan and nitrous oxide. This form of anesthesia is warmly recommended. In long operations anesthesia is introduced with evipan, and thereafter small quantities of evipan are given together with nitrous oxide. The nitrous oxide apparently weakens the effect of the evipan on the respiratory centers. Premedication with morphine or scopodal is important.

to the success of the narcosis Postnarcotic agitation is exceedingly rare nowadays If necessary spinal anesthesia may well be combined with light evipan anesthesia in order to reduce the patient's symptoms

Jaundice of long standing (severe hepatic damage) is the only absolute contra-indication for evipan anesthesia In diabetes, on the other hand, evipan constitutes a highly suitable anesthetic agent Given perfect technique, evipan entails no risks, and complications following this form of anesthesia are now exceedingly unusual

### Résumé.

La narcose intraveineuse est aujourd'hui en pratique depuis 10 ans Elle gagne toujours plus de terrain et refoule heureusement toujours davantage celle à l'éther L'Evipan continue à être l'anesthésique principal L'auteur a administré plus de 8,000 narcoses à l'Evipan de 1933 à 1942 Pendant cette période la proportion des narcoses intraveineuses dans l'ensemble des anesthésies générales est montée de 30 à 90 % tandis que celle des narcoses à l'éther a baissé de 40 à 10 % Le pourcentage des anesthésies locales n'a pas changé

Dans le II<sup>d</sup>-Service Chirurgical de l'Hôpital Sahlgren on a pratiqué pendant l'année 1942 1,673 narcoses intraveineuses, dont 839 à l'Evipan seul et 692 anesthésies combinées Le nombre des narcoses à l'éther seul a été de 51, et le nombre de l'éther mélangé à un autre produit de 160 — Dans les cas rebelles on ne doit pas essayer d'obtenir de force une narcose complète en augmentant la dose d'Evipan mais de passer à la narcose combinée, en associant de préférence l'Evipan au protoxyde d'azote Cette forme d'anesthésie générale est chaudement recommandée Dans les opérations de longue durée on commence la narcose avec de l'Evipan dont on donne ensuite de petites doses tout en administrant du protoxyde d'azote Le protoxyde semble atténuer l'action de l'Evipan sur les centres respiratoires La médication préopératoire par la morphine ou le Scophédal a de l'importance pour le cours de la narcose Les états d'excitation postopératoire sont à cause de cela devenus extrêmement rares à l'heure actuelle La rachianesthésie peut, en cas de besoin, être avantageusement combinée avec une narcose superficielle à l'Evipan pour diminuer les troubles subjectifs des malades

La seule contre-indication absolue à l'usage de l'Evipan est un ictère de vieille date (lésions hépatiques sérieuses) Dans le diabète, en revanche, l'Evipan représente une forme d'anesthésie très adéquate Moyennant une technique parfaite la narcose à l'Evipan est sans danger et amène rarement des complications aujourd'hui

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From the Department D. of Surgery, Rigshospitalet,  
Copenhagen, Denmark.  
(Chief Surgeon: Prof. S. KJÆRGAARD.)

## Partial Pancreatectomy for Hyperinsulinism

Report of 3 Cases.

By

S. KJÆRGAARD.

The first operations for hypoglycemic attacks due to hyperinsulinism were performed in the late twenties of this century. In the first case operated upon by WILDER in 1927 it was a question of a malignant islet cell tumour. The patient had metastases in the liver and died one month later. In 1929 ROSCOE GRAHAM was the first to cure a patient of hyperinsulinism and the accompanying hypoglycemic attacks by removing a benign islet cell tumour.

Since then a rapidly increasing number of operations for hyperinsulinism have been reported. Experience has shown that in most cases the cause of the hyperinsulinism has proved to be tumours arising from the cells of the islets of Langerhans, as a rule benign and enucleable, but experience has also shown that a considerable number of patients with similar case histories and clinical findings before the operation have not revealed circumscribed, removable tumours of the pancreas. In such cases partial pancreatectomy has been performed of a greater or less extension, ranging from quite small to subtotal.

The prospects of cure in the two different circumstances and of the two procedures — extirpation of the tumour and pancreatectomy respectively — have proved very varied. Cases of demonstrable, circumscribed islet cell tumours have yielded much more satisfactory results after operative treatment than cases where no circumscribed tumour has been demonstrable and partial pancreatectomy therefore has been performed.

The insulin-producing tumours originating from the cells of the islets of Langerhans, the islet cell tumours, are mostly benign (adenomas), but may be malignant (carcinomas). In our Department we use the word insuloma as a general term for the islet cell tumours.

Signs suggestive of malignancy were previously considered to be found in almost one fourth of the cases. The cases in which the operation or the autopsy have revealed metastases are of course malignant beyond doubt. Recent investigations, however (K. FRANTZ, *Annals of Surgery* 112—1940) indicate that malignancy is not as common as formerly presumed, several patients without signs of metastases, but with histological findings in the extirpated tumour suggestive of malignancy having survived for so many years that grave doubts must arise concerning the maintenance of the criteria (incomplete encapsulation, tumour cells invading the vascular lumina) on which the histological diagnosis of malignancy was based.

A sufficiently large number of patients as well as sufficiently long follow-ups after the removal of insulomas have been reported in order to establish the fact that a radical cure may be obtained by such removal. According to the above-mentioned, malignancy plays a minor part than previously presumed. The uncertainty of the post-operative prognosis is especially to be found in the difficulty in discovering the insulomas and in the attendant risk of leaving some behind in case of multiplicity. Recurrences have been observed in several cases after the removal of insulomas, and in these cases cure has only been obtained after a re-operation with removal of further insulomas overlooked at the first operation.

Considering the small size of these tumours, cherry, pea, or smaller, it does not seem strange that a tumour may be overlooked, even if the surgeon has performed the exploration knowing that they may be present in plural, and that they may be encountered in the head, which is most inaccessible, although the most frequent site of these tumours is the body and tail where the normal islet tissue also is most abundant.

Since 1939 insulomas have been removed in 5 cases in my Department. In *Acta chir. sc.* Vol. 84, 1940 P. WINDFELD has reported the first 3 cases, and an article by the same author in *Ugeskrift for Læger* 1941 contained our fourth case. It was a fat woman of 60 with serious, disabling attacks for 6 years, a hazel nut sized

insuloma was removed from the body of the pancreas; there was some post-operative increase in the diastase content of the urine and some aqueous, non-corroding, gradually decreasing secretion through a drainage tube. Otherwise the patient felt well and had normal blood sugar values, until she suddenly and unexpectedly died of pulmonary embolism 35 days after the operation.

A 5th case, a male, age 47, was operated upon in October 1942. He had been having typical attacks, and was disabled by them. A cherry-sized insuloma was removed from the tail of the pancreas. Post-operative course without complications, normal blood sugar values, discharged 3 weeks after the operation. Has later reported that he is feeling well and has no attacks.

But besides these extirpations of insulomas we have performed partial pancreatectomy in 3 cases during the last few years. It is these cases that will be dealt with in the present paper.

As already mentioned experience has shown that the results after a resection of the pancreas are far more uncertain than those after the removal of insulomas. It is difficult to form a view of the situation from the spread literature on the subject. Pancreatectomy has been performed in cases where the particulars available have left some doubt as to whether the attacks really were due to hyperinsulinism. The size of the resected parts has varied considerably, from 5—8 grammes up to more than 50 grammes.

In an article in *Journal internat. de Chir.* Vol. 3, 1938, WHIPPLE has reported his own cases and given a tabular survey of the published operations by other authors for hyperinsulinism, including pancreas resections. Out of 34 resections 4 died, 10 were cured, 4 improved, 13 did not improve, sufficient particulars were lacking in 3 cases.

In *Acta chir. sc.* Vol. 83, 1939 ÅKERBERG, reporting a case of islet adenoma, considers the results of resection so poor, that he advocates not to resect if no tumour is found.

Later V. C. DAVID (*Surgery* Vol. 8, 1940) has given a survey of the reported cases. In some cases resection was used in order to remove a proved, circumscribed tumour, in other cases a further examination of the resection specimen has revealed an insuloma not proved in advance. As might be expected these cases have the same good prospects for the future as those obtained by isolated excision of insulomas. But the bulk of resection specimens reveal no insulomas, hyperplasia and hypertrophy of the islands of Lang-

erhans have been encountered in a number of cases, but frequently nothing abnormal has been demonstrable in the islet tissue. In these cases the results have been less satisfactory. DAVID has thereupon divided the cases into two groups according to the size of the resected parts. Out of 18 cases in one group where 8—28 grammes had been removed 3 were cured, 3 improved, 8 unimproved, and 4 died. 17 cases of subtotal resection (from 35 grammes up to 90 per cent of the pancreas) had 11 cured, 1 improved, 4 unimproved, and 1 had died. Accordingly there can be no doubt that the prospects of cure are considerably better in cases of large resections than small ones.

Besides, the survey contains a few cases in which the resection had not resulted in improvement and where a re-operation revealed an insuloma in the head. The removal of this tumour then resulted in a cure.

In the fifth patient who was admitted to us for operation for hyperinsulinism I could find no tumour and therefore had to contemplate resection. The impression I had received from the published results of such interventions was, however, far from encouraging, and it was with grave doubts that I undertook the operation. Now I have performed resection in 3 cases which contribute to showing the justification of this intervention.

Before giving the case reports a few remarks about the examination of patients with hypoglycemic attacks. In all the cases of spontaneous hypoglycemia operated upon in our Department there have been grave, disabling attacks (with unconsciousness, convulsions etc.). All the patients have been examined with due regard to lesions in the hypophysis, adrenal, or liver which could be supposed to have caused the hypoglycemia, without revealing signs of such lesions. The diseases in the hypophysis and in the adrenal that must be borne in mind in this relation give such pronounced symptoms beside hypoglycemia that they may be recognized with comparative ease. The same thing holds good for some of the liver diseases, but reports exist (J. CONN, J. A. M. A. 20, 1940) indicating a reason for paying increased attention to the liver in cases of hypoglycemia and effecting a careful examination of the hepatic function and the bile ducts. The thyroid gland is worth attention too, increased function with enhanced basal metabolism may be a compensatory measure whereby the thyroid gland mobilizes more glycogen from the liver. Various reports (WOMACK and COLE, AITKEN) serve to emphasize what an errone-

ous estimation of this condition may lead to In all the operated cases the Whipple triad has been present, the typical attacks revealing a hypoglycemia with readings below 50 mg per cent and thereupon immediate relief upon ingestion of sugar, most striking on intravenous injection of glucose When the attacks thus have been recognized as hypoglycemic and extra-pancreatic causes are not demonstrable, the hypoglycemia presumably is due to hyperinsulinism It would be an advantage to be able to establish this further by functional tests which could demonstrate hyperinsulinism more directly Much work has been done in the way of blood sugar curves, glucose tolerance tests, injection of adrenalin and insulin, but hitherto these methods have failed to supply a reliable assistance in the differential diagnosis of the possible causes of hypoglycemia It would also be advantageous to be able to decide whether there is an insuloma, before operating for hypoglycemic attacks due to hyperinsulinism ALLAN BERRY (Journal of Surgery, Vol 23, 1935) considered that he could be guided in this matter by the blood sugar curves after tolerance tests with varying amounts of glucose, but this has not been confirmed by others

Suppose that no insuloma can be found on operation in a case where the Whipple triad has been observed and a diagnosis of hypoglycemic attacks presumably due to hyperinsulinism, has been passed, the surgeon finds himself in a very unpleasant situation In the first place this may give rise to an uncertainty as to whether the hypoglycemia actually is due to hyperinsulinism, or whether the cause must be sought outside the pancreas in spite of the pre-operative examination But if he is satisfied that the cause of the hypoglycemia is to be sought in the pancreas, he considers the question of partial pancreatectomy It is a decision which must be made after a frequently lengthy and difficult explorative intervention It is especially difficult to rule out the possibility of an insuloma in the head It has happened several times that partial pancreatectomy has been done without a result and a later operation has revealed an insuloma in the head (V. C. DAVID, 1 c, VAN BECK and collaborators, Acta med sc Vol 112, 1942) In the three cases, where I have found myself in this situation I performed partial pancreatectomy, and below I shall give the case reports

*Case 1* A labourer age 40, operated upon in December 1940 He had had hypoglycemic symptoms for about 9 years They began with brief



fainting spells during hard work, also causing him to fall off his bicycle a few times on his way home from work. Noticed that intake of food gave relief, before the attacks hungry and feeble, after the attacks headache and exhaustion. The attacks increased in intensity and frequency, also occurred in the morning, if he did not get his breakfast in time. In 1938 an attack of unconsciousness during work, was taken to the hospital where hypoglycemia was ascertained (60 m g per cent). Sugar was recommended to control the attacks. The latter, however, gradually increased in frequency and duration, with unconsciousness for  $1\frac{1}{4}$ — $1\frac{1}{2}$  hour, sometimes 1—2 hours and there were convulsions. During one attack he fell down and got a wound at the back of his head. By and by he had difficulty in getting a job. Was admitted to the medical department B of the Rigshospital, where he lay for a fortnight. During that time his fasting blood sugar as a rule was about 50 m g per cent, minimum about 30, once only 25 m g per cent, maximal value during the 24 hours 107. The Whipple triad was ascertained with hypoglycemia during the attacks and relief on injection of glucose. Examination with regard to hypophysis, adrenal, liver, and bile ducts revealed nothing abnormal, metabolic values normal. Urinary diastase once 512, otherwise normal.

Transferred to Dept D and operated upon Dec 5th 1940. Before the operation 1 litre of 5 per cent glucose was administered subcutaneously. Ether anesthesia. Curved transverse incision according to Whipple. Adhesions between the posterior surface of the ventricle and pancreas and between the duodenum and gall bladder. No stones in the gall bladder, no signs indicating an ulcer. No visible or palpable tumour in the pancreas, not even after mobilization in the typical manner incising the peritoneum along the inferior border — or in the head after mobilization of the duodenum.

We decided to perform pancreatectomy in spite of the rather discouraging results contained in the literature on the subject. On account of the rather lengthy exploration I wanted to avoid splenectomy. The tail and body were mobilized a long way until we came to a point where the splenic vessels entered the pancreas in such a manner that further mobilization would require ligation and splenectomy. Oblique resection was applied so that the larger part was taken from the inferior border. The removed part was 8 cm in length. Silk suture of the pancreas. Meche and drainage.

Diastase figure on the first day 400, later normal. Fasting blood sugar primarily enhanced, later about 100 (84—130). The urine showed sugar reaction during the first two days, not later. The post-operative course was prolonged by secretion through the drainage tube and phlebitis of the calf. Discharged 7 weeks after the operation. Regrettably the resected part was not weighed.

Half of the resected part was sent to Niels Steensen's Hospital to be examined for insulin content. "The tissue examined was found to contain insulin corresponding to 1.25 international units per gramme. This approximately corresponds to the normal in a pig's pancreas (1.4 international units per gramme)" sd HAGERDORN. The other half was

sent to the Patho-Anatomical Institute for histological examination<sup>1</sup> There was hyperplasia of the pancreatic islands, some parts containing densely set islands of up to double their normal size, in other places no increase could be observed

*Subsequent course* Since the operation the patient has kept completely well, has been able to stand hard physical work without evidence of his former complaint Fasting blood sugar in June 1943 116—125 m g per cent in Dec 1943 109 m g per cent His condition having remained satisfactory for 3 years there is every reason to expect that this partial pancreatectomy has permanently cured the patient of his extremely grave disease

*Case 2* Textile worker, age 25 Operated upon May 28th 1942 It is a case of recurrence In July 1939 the patient had been operated upon and 2 insulomas, the size of a pea, had been removed He is our only case of recurrence after excision of insulomas The patient is identical with No 2 in P WINDFELD's article in Acta chir As to the earlier case history we can refer to the mentioned article. Before the first operation he had had severe hypoglycemic attacks Only a few months after the operation the attacks returned An experimental diet of abundant vegetables was of no avail The hypoglycemic attacks increased in violence and frequency with convulsions and protracted unconsciousness The attacks mostly occurred in connexion with work, but they also came in the night During the last few months he had had daily attacks

Re-admitted on May 4th 1942 General condition satisfactory, general examination revealed nothing abnormal

Fasting blood sugar was found to be 50—60 m g per cent A mild attack was brought about by garden-work — blood sugar 48 m g per cent The attack subsided after intravenous injection of glucose During a prolonged fast the blood sugar measured with intervals of 1 hour from 8 a m gave the following readings 52, 58, 44, 36, 46, and at 1 p m 32 m g per cent, a violent attack followed, but was relieved by intravenous glucose Besides, several mild attacks were observed

The particulars of the anamnesis having been confirmed by observation in the Department and the Whipple triad having repeatedly been watched, we decided on re-operation there being no doubt that the attacks were of a serious character We hoped to find further insulomas which could be removed

On May 28th 1942 the operation was performed under ether anaesthesia Curved transverse incision in the old cicatrix left by the incision according to Whipple Very extensive adhesions made the access difficult, there were also very severe adhesions in the epiploic sac After loosening these adhesions the pancreas was exposed, veiled by a coating of adhesions The tail felt somewhat gritty, but without positive insulomas, we did not either succeed in palpating nodules in the body

<sup>1</sup> V ESKELUND, M D, the pathologist, will elsewhere report the microscopical examination of the insulomas removed and the parts of pancreas resected in the Department, for which reason this paper only states the results

or head after mobilization of the duodenum. Partial pancreatectomy was performed. The splenic vessels were in such intimate connexion with and entering into the pancreas that splenectomy became necessary, and was effected without particular difficulty. Thereupon the pancreas and the splenic vessels were moved quite a long way to the right of the aorta. The splenic vessels were ligated with Dechamps and cut, only one lumen was observed. The resection of the pancreas started a violent venous hemorrhage, the vena lienalis not having been ligated, it was got hold of and ligated. Silk suture of the pancreas. Drainage.

The piece removed was 12 cm long (Was regrettably not weighed).

The patient was exhausted after the operation, blood transfusion was applied with excellent effect. Was febrile during the first days, somewhat restless and confused. Post-operative course otherwise without complications. No increase in the urinary diastase content. Slight secretion from the drain. Out of bed 3 weeks after the operation. Fasting blood sugar was somewhat enhanced (180—190 mg per cent) during the first two weeks. At the same time a few days' glycosuria. After that normal blood sugar values and no sugar reaction in the urine.

During the operation the consistency of the pancreatic tail was found to be gritty. Grossly, V. Eskelund M.D., the pathologist, found no certain tumours, but microscopy of a large number of specimens revealed 9 insulomas. In all 4 of them had a diameter of less than 1 mm and the remainder had a diameter of up to 4 mm.

*Subsequent course.* Since the operation the patient has been in good health, fully capable of working without evidence of his earlier attacks. Several times the fasting blood sugar has been measured and normal values have been found (109 — 97 — 90 — 104 mg per cent). The most recent particulars are from Nov. 29th 1943, i.e. 1½ years after the operation.

*Case 3.* A waiter, age 50, operated upon in August 1943. Mother died of diabetes. The patient had been obese ever since his youth, before his disease he had been a heavy drinker. The disease began 11 years ago with a brief attack of universal perspiration, indisposition, dizziness. The next attack occurred six months later after which time the attacks increased in frequency and duration, often involving unconsciousness and universal convulsions (no aura, no excretion, never biting of the tongue). The attacks hardly ever occurred in the morning, but nearly always about 3 p.m. (meals at 12 noon and 6 p.m.). A couple of years after the onset of the symptoms he was admitted to a Hospital for Epileptics for observation. No attacks during his stay there. Since then he has received a daily dose of 30 c.g. of luminal.

The attacks increased in frequency and intensity, getting an almost daily occurrence during the latter years. He lost his job and was unable to support his family. Had to live on union assistance.

In May 1943 he was admitted to the neurologic department of the Rigshospital for observation for cerebral lesions, epilepsy? Clinical-neurological examination and spinal fluid showed nothing abnormal.

X-ray of the skull Calcification, the size of a pea, in the vertex, sella and alae normal Encephalography revealed both lateral ventricles dilated and they seemed to be somewhat dislocated to the right, moderate air basally, but enlarged and broad sulci, especially in the region of the right hemisphere Fasting blood sugar 52—63 m g per cent He had 3 attacks with perspiration, universal vascular dilatation, motor unrest, salivation, during which he soon was fully conscious, and soon vacant Blood sugar during attack 33 m g per cent The department passed a diagnosis of encephalopathia diff crypt, hypoglycemic attacks, and transferred the patient to the department of surgery for observation for pancreatic adenoma

We found the fasting blood sugar to be 73—117 m g per cent, after a prolonged fast 76, during a mild attack 83, and did not find indications which could justify an operation The patient was returned to the neurologic department whence he was sent to a medical department Here a prolonged fast showed a drop in the blood sugar from 64—48 m g per cent and a violent attack was observed with blood sugar of 36 m g per cent The patient was then re-admitted to surgical department D on July 21st, where he remained under observation until August 31st, before it was decided to operate His weight was 93 kilos to a height of 174 c m and he gave a dull, somewhat demented impression Cholecystography normal Galactose test negative No signs suggestive of lesions in the adrenal Encephalography see above

Fasting blood sugar extremely varied, minimum 55 and 58, as a rule higher, up to and above 100 m g per cent Garden work did not entail an attack Several mild and more severe attacks were observed, they occurred in the afternoon about 4 or 5, also after meals During the attacks blood sugar values of 81, 72, 51, 74, and 90 m g per cent were measured Not until we observed a violent attack on August 26th at 5 p m involving universal convulsions and unconsciousness, blood sugar 49 m g per cent and relief after intravenous administration of glucose, did we suggest an operation to the patient

In several respects his case deviated from the ordinary course of hyperinsulinism in a perplexing manner, especially by attacks without hypoglycemia But several attacks fulfilling the claims of the Whipple triad having been observed and no extra-pancreatic causes of hypoglycemia being demonstrable, we met the patient's wish in trying to relieve his distressing condition by an operation

Before the operation 50 grammes of glucose were administered Curved transverse incision according to Whipple under ether anesthesia The obesity was considerable and inconvenienced a great deal The pancreas and surroundings were concealed behind abundant fatty tissue No visible or palpable tumour The tail and body were mobilized by incision along the lower border, mobilization of the duodenum in order to get access to palpate the head The fatty tissue made the exploration difficult and uncertain

The tail and body were resected The renal vessels could be mobilized by blunt dissection The tail was pulled up from the great depth by a forceps and divided from the renal hilus by blunt dissection, a slight

hemorrhage was checked by tamponage. After the ligation of a few small veins the pancreas was mobilized so far to the right that the mesenteric vessels were exposed without lesion to the splenic vessels. Wedge-shaped resection, silk suture of the stump. Iodoform mèche for the splenic hilus and the pancreas stump, besides drain.

Post-operative course quiet with a moderately raised temperature during the first week. Diastase figure not above 300. Some thin, non-corroding secretion through the drain. The wound healed per primam. The drainage canal healed in 4 weeks. Fasting blood sugar minimum 99, as a rule 120—140 mg per cent, a few times somewhat higher. Urine contained no sugar.

The patient was discharged on Oct 16th. Had then been free from symptoms for well over 6 weeks after the operation.

The resected part measured 10 cm in length and weighed 40 grammes. Grossly it revealed no tumours. The microscopy revealed "the islands in strikingly large numbers and size", and the pathologist, V. Eskelund, passed a diagnosis of hyperplasia insularis pancreatis.

*Subsequent course.* In a letter 3 months after the operation the patient's wife reported that one day 4 weeks after his return home he had an attack of perspiration and trembling of the hands, the attack quickly subsided, and otherwise there has been nothing that could remind of the former attacks. Fasting blood sugar 89 mg per cent. He feels well and has started working again. There can be no doubt that the operation has definitely improved his condition, but it is too early yet to predicate whether the improvement will be permanent. Possibly the above-mentioned spell of perspiration and trembling was a beginning attack, but in this connexion it is worth mentioning that the domestic surroundings seem rather highly strung and very nervous.

2 of our 3 cases have been followed up so long (3 and 1½ years) that there is reason to believe that they have been cured by the pancreatectomy. The third case looks promising, but the follow-up is hitherto so brief that a recurrence cannot be ruled out. Besides, the attacks offered so many peculiarities that one must be prepared that possibly not only the production of insulin, but also other factors regulating the metabolism of carbohydrate have been in disorder in this case. But on the whole the results have exceeded my expectations.

Reviewing the published cases of pancreatectomy DAVID 1 c has demonstrated that better results are obtained by large resections. Comparisons have been made with strumectomy for Basedow's disease. Pancreatectomy cannot become as subtotal as strumectomy, but it is the parts accessible for resection (tail and body) that contain the largest amount of islet tissue.

The total weight of the pancreas is stated to be 60—90 grammes, the parts resected in the cases published have varied from 5—8

grammes to more than 50 grammes. In my third case the part removed weighed 40 grammes, judging from the length of the removed part No. 2 has probably had a similar weight, No. 1 possibly somewhat less. So even if the resections cannot be called subtotal, they have been large in all three cases. There is hardly any risk of incurring diabetes by pancreatectomies for hyperinsulinism. In dogs 80 per cent of the pancreas must be removed before they develop diabetes. Transitory hyperglycemia and a slight glycosuria were observed in Nos. 1 and 2.

When deciding to perform a pancreatectomy for hyperinsulinism it seems justified to try to make it as extensive as possible. If the splenic vessels cannot be sufficiently isolated from the pancreas, they must be ligated and splenectomy performed.

There being a risk of hypoglycemic attacks involving permanent damage to the brain, the operation should not be put off too long in the more severe cases. In my 3rd case the patient gave a peculiar, dull, somewhat demented impression, it is possible that the frequent attacks of many years' standing have been contributory to his psychic condition and maybe also to the encephalographic changes observed.

### Summary.

The author mentions 5 cases of benign islet cell adenomas (insulomas) which have been removed by operation in his Department since 1939.

Now he reports 3 cases of partial pancreatectomy for hypoglycemic attacks due to hyperinsulinism. One of these cases was a recurrence, insulomas having been removed earlier.

Cases No. 1 and No. 2 are quite free from symptoms 3 and 1½ years respectively after the operation. In the third case only 3 months have elapsed since the operation, and the patient has had an attack of perspiration and trembling which may be a beginning hypoglycemic attack. The author emphasizes the risk of overlooking a tumour, especially in the head of the pancreas, in operating for hyperinsulinism.

If the diagnosis of hyperinsulinism can be regarded as certain and no tumour is demonstrable, partial pancreatectomy is indicated and should be made as extensive as possible.

### Zusammenfassung.

Verf. teilt mit, dass in seiner Abteilung seit 1939 bei 5 Patienten gutartige Insel-Zellenadenome (Insulome) entfernt worden sind.

Jetzt werden 3 Fälle von partieller Pankreatektomie wegen durch Hyperinsulinismus bedingter, hypoglykämischer Anfälle mitgeteilt. Einer der Fälle war eine Rezidivoperation, indem früher Insulome entfernt worden waren.

Zwei der Fälle sind 3 bzw.  $1\frac{1}{2}$  Jahre nach der Operation vollg. symptomfrei. In dem dritten Falle sind seit der Operation nur 3 Monate verflossen, und der Kranke hat vielleicht einmal Anzeichen eines drohenden hypoglykämischen Anfalles gehabt. Es wird die Gefahr hervorgehoben, bei einer Operation wegen Hyperinsulinismus einen vorliegenden Tumor, besonders im Caput pancreatis, zu übersehen.

Wenn die Diagnose Hyperinsulinismus als sichergestellt anzusehen ist, und sich kein Tumor nachweisen lässt, so ist partielle Pankreatektomie indiziert und sollte in grossem Ausmasse vorgenommen werden.

### Résumé.

L'auteur signale que dans son Service, depuis 1939, on a enlevé des adénomes insulaires bénins (insulome) à 5 malades.

Il communique maintenant 3 cas de pancréatectomie partielle pour crises hypoglycémiques dues à de l'hyperinsulinisme. Dans l'un des cas il s'agissait d'une opération itérative attendu qu'on avait précédemment enlevé des insulomes.

Deux des sujets sont débarrassés de tous leurs troubles, 3 et  $1\frac{1}{2}$  ans après l'opération, pour le troisième il ne s'est écoulé que trois mois depuis l'intervention, et peut-être a-t-il présenté une esquisse de crise hypoglycémique. L'auteur souligne le danger de méconnaître l'existence d'une tumeur, surtout dans la tête du pancréas, lorsqu'on intervient pour hyperinsulinisme.

Quand le diagnostic d'hyperinsulinisme doit être considéré comme certain mais qu'aucune tumeur ne peut être mise en évidence la pancréatectomie partielle est indiquée, et il faut la faire large.

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Aus dem Krankenhause der Diakonissenanstalt zu Helsingfors  
(Vorstand: Prof F LANGENSKIOLD)

## Eine neue Operationsmethode für grosse Bauchbrüche.

Von

F LANGENSKIOLD,

Helsingfors

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Die Beseitigung eines grossen Bauchbruches ist bisweilen eine sehr heikle Aufgabe, wovon auch die vielen vorgeschlagenen Operationsmethoden zeugen. Ausser der einfachen Vernahung der Ränder der Bruchpforte, meistens nach ihrer Aufspaltung in die natürlichen Schichten, breite Auflagerung der Ränder oder ihre Nahe- rung durch eingelegte Drahtnahte, hat man auch die Einlegung verschiedenartigen Materials, wie gegliederte Silbernetze, (GOE- PEL), Faszienstücke (KIRSCHNER) oder Netze von Faszienstreifen (GALLIE & MESURIER) sowie Stücke der Lederhaut (REHN) voi- geschlagen.

Seit einigen Jahren habe ich eine Methode angewandt, bei welcher der narbige Bruchsack in einer, soweit ich habe finden können, nicht vorher beschriebenen Weise ausgenutzt wird. Zur Beschreibung der Methode wird als Beispiel die Operation eines Narbenbruches oberhalb des Nabels gewählt.

Die Hautnarbe wird umschnitten und so sauber wie möglich von dem darunter liegenden narbigen Bruchsack abpräpariert. Dieser soll möglichst geschont werden, kleine Locher machen jedoch nicht die Anwendung der Methode unmöglich.

Nachher wird der Bruchsack in querer Richtung geöffnet und alle Verwachsungen werden gelöst. Dann spaltet man den ganzen Bruchsack in fingerbreite querverlaufende Streifen (es entstehen deren meistens 6—7) von welchen jeder zweite rechts, jeder zweite links dicht am Rande der Bruchpforte abgeschnitten wird (Figg 1 und 2).



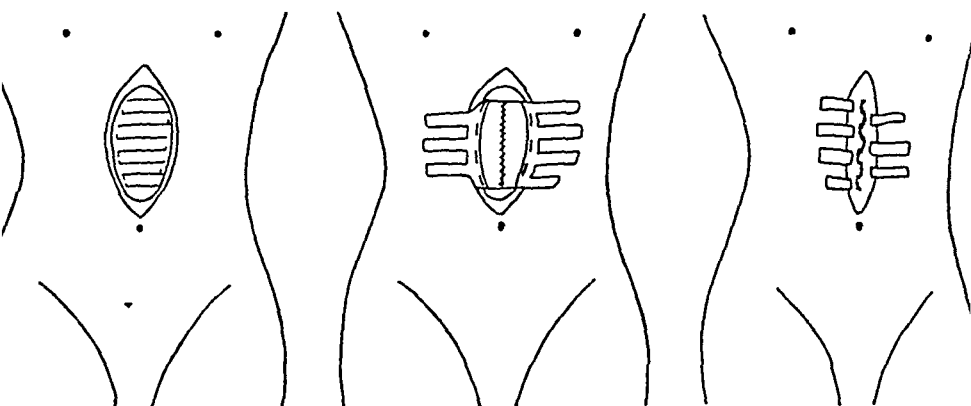


Fig 1

Fig 2

Fig 3

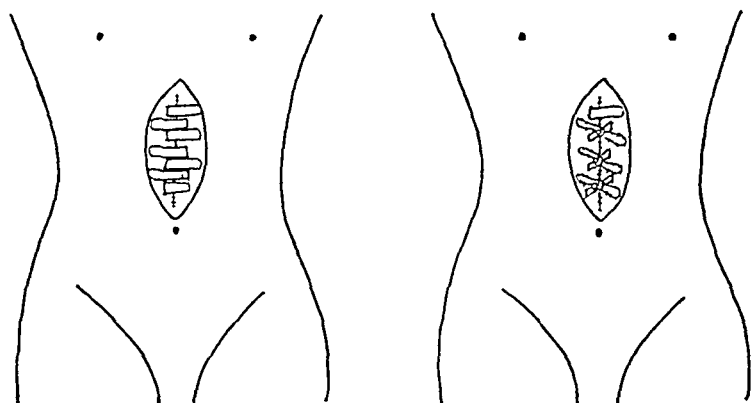


Fig 4

Fig 5

Das Bauchfell wird von der Faszie gelöst und, wenn möglich, für sich genäht. Dieses ist aber nicht unbedingt nötig. Dann macht man, jedem Streifen der anderen Seite entsprechend, in die hintere Rectusfaszie einen kleinen Einschnitt, etwa daumenbreit von dem Rande entfernt (an der Figur 2 sind die Einschnitte etwas zu nahe dem Rande gezeichnet), stösst den Muskel mit einer Arterienklemme durch und schneidet auf ihr die vordere Faszie ein. Die entsprechenden Streifen werden durch die Locher gezogen und durch Ziehen an sie die Ränder aneinander gebracht, was erstaunlich leicht gelingt. Die Streifen halten viel mehr, als man ihnen zutrauen würde. Die Faszienränder werden mit Seidennähten aneinander befestigt, ebenso die Streifen an den Rändern der Locher (Fig 3).

Nachher kann man entweder die Streifen zurückklappen und

über die erste Nahtreihe mit weiteren Nahten befestigen (Fig. 4), oder man kann sie je zwei zusammenknoten und erst dann die Enden an die Faszia nahn (Fig 5). Die Knoten gleiten leicht und sollten durch besondere Nahte gesichert werden. Die Streifen sind meistens zu lang, das überflüssige wird weggeschnitten. Die Hautwunde wird am besten mit Klammern verschlossen, um keine durchgehende Stichkanäle zu machen.

Die Knotenmethode scheint mir sicherei, hat aber den Nachteil, dass dadurch den Patienten beunruhigende und vielleicht storende Knoten in dem Unterhautgewebe entstehen.

### Zusammenfassung.

Eine neue Operationsmethode für grosse Bauchbrüche. Die Hautnarbe wird so sauber wie möglich entfernt, der Bruchsack in querer Richtung geöffnet und dann in fingerbreite, querverlaufende Streifen gespaltet, von welchen jeder zweite rechts, jeder zweite links dicht am Rande der Bruchpforte abgeschnitten wird. Das Bauchfell wird genaht, wenn möglich, die Streifen werden durch Locher etwa 2 cm vom entsprechenden Rande der Bruchpforte gezogen, die Ränder durch Ziehen aneinander gebracht und genaht. Die Streifen werden paarweise befestigt, und die Knoten mit Suturen gesichert.

### Summary.

The author describes a new operative method for the treatment of large abdominal hernias. The cutaneous scar is removed carefully, the hernial sac is opened with several parallel incisions, so as to create a number of strips about two centimeters wide, which are detached at one end, alternating between right and left. The peritoneum is closed, if possible, the strips are drawn through holes about two centimeters from the opposite margin of the orifice of the hernia, and tautened so, that the margins can be sewn together, and knotted by pairs. The knots are reinforced with sutures.

### Résumé.

Nouvelle méthode opératoire des grandes hernies abdominales. On extirpe prudemment la cicatrice cutanée et l'on ouvre transversalement le sac par plusieurs incisions parallèles de façon à obtenir un certain nombre de languettes, larges comme le doigt, qu'on sectionne à l'une de leurs extrémités, alternativement à droite et à gauche. Après fermeture, si possible, du péritoine, on fait passer les languettes par des boutonnières à environ deux cm du bord opposé de l'orifice herniaire, on tire dessus de manière à pouvoir suturer les lèvres de l'éventration et on noue les languettes deux à deux. On assure les nœuds par des points de suture.

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From the 1 st Surgical Department of Sabbatsbergs Sjukhus  
(Head Docent C CRAFOORD)  
and the Medical Department of Kronprinsessan Lovisas  
vårdanstalt för sjuka barn  
(Head Prof A LICHTENSTEIN)

## The Diagnosis and Treatment of Patent Ductus Arteriosus (Botalli), in Connection with 20 Operated Cases.

by

C CRAFOORD, E MANNHEIMER and TH WIKLUND

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In 1938 the American GROSS performed the first successful operation on patent ductus arteriosus. This event produced an increased interest for this congenital anomaly of the heart, which has been known for a long time.

The ductus arteriosus was first mentioned by GALEN in the 15 th century. A more detailed description of its anatomy was given in the 16 th century by LEONARDO BOTALLLO, who showed, that this connection between the aorta and the pulmonary artery, could remain patent after birth in rare cases. The credit of having brought the problem of the diagnosis a great step forward is due to the Englishman GIBSON, who in the year 1900 proposed the conception *continuous murmur*, that has proved to be the cardinal symptom of this anomaly. GIBSON's discovery was published in the Edinburgh Medical Journal in the year 1900, but was soon forgotten, and has only during recent years received the attention it deserves. By phonocardiography we now have the possibility of objectively registering the murmur, which has proved to be of considerable importance for the special diagnosis. In fact, our diagnostic possibilities are now so great, that, where this anomaly is the sole lesion, the diagnosis of patent ductus arteriosus can be established with certainty in almost every case. MONROE was the first one to propose surgical treatment of patent ductus arteriosus, and in 1907 he indicated that this anomaly could possibly be treated surgically. In 1937 GRAYBIEL, STRIEDER and BOYER tried to ligate a ductus arteriosus in a case complicated by bacterial endocarditis, but the patient died a few days after

the operation In 1938 O SHAUGNESSY planned a similar operation, during which, however, he found that there was no patent ductus arteriosus but another anomaly, thus the intended operation was never performed GROSS, who as mentioned above, was the first one to perform a successful operation on patent ductus arteriosus, has so far published 10 operated cases (1940), BULLOCK, JONES and DOLLEY 13 cases (1940), BIGGER 1 case (1940), GURD 1 case (1940), HOLMAN 1 case (1940), CAMES 1 case (1941), CRAFOORD 1 case (1942), VALDONI 1 case (1942), BUUS and HOLTEV 1 case (1942), HUMPHREYS 16 cases (1942), TOUROFF 11 cases (1943) and HULTÉN 1 case (1943) Thus 59 operated cases in all are published sofar

Our material includes 20 patients, that have been operated upon in the Sabbatsberg's Hospital during 1941—1943 (the case published by CRAFOORD in 1943 is also included) In 16 of these cases the definite diagnosis has been arrived at at the Kronprinsessan Lovisas vardanstalt for sjuka barn

### Morbid Anatomy and Functional Pathology.

During foetal life, when the blood is oxygenated in the placenta, the amount of blood, that circulates through the lungs, is inconsiderable, and the greater part of the blood in the pulmonary artery is shunted through the ductus arteriosus to the aorta At birth, however, when the lungs take charge of the oxygenation of the blood, the ductus arteriosus is closed by a process, that, according to SCHAEFFER is similar to an obliterating endarteritis Usually this process ensues immediately after birth, but in many cases it does not occur until sometime during the first year of life In examining large material the conclusion has been reached, that in 2 % of the cases the ductus arteriosus has still shown signs of patency at 1 year of age (CHRISTIE) The reason of this is still unknown, and of the different theories, that have been proposed to explain this abnormal circumstance, none has been generally accepted

The ductus arteriosus goes from the pulmonary artery, in the vicinity of its division, in an oblique dorso-cranial direction to the aorta Its length varies within wide limits Owing to its oblique direction two sides can be distinguished, one long cranial and another short caudal side The long side has in our cases

varied between 15 and 3 mm., the short one between 9 and 1 mm. of length. In addition there was one case, where no real ductus was present, but the aorta and the pulmonary artery were found close together with a direct intercommunication. In most cases, the length of the long and the short side have been 4 and 3 mm. respectively. The circumference of the ductus varies a great deal as well as its length, in our cases from 51 to 8 mm., the mean value being about 30 mm. (table II).

Atheromatous alterations in the wall of the ductus arteriosus are often produced by the whirls of the blood stream, as has been demonstrated by microscopic examination of autoptic material (GROSS). The ductus arteriosus often becomes the site of bacterial endarteritis because of these alterations. On palpation of the ductus arteriosus one can gain certain information as to the state of the wall. In some cases it seems very brittle, while in others it has the character of a normal blood vessel.

Patent ductus arteriosus sometimes coexists with other congenital affections of the heart. In certain cases of morbus caeruleus a patent ductus arteriosus is indispensable for the circulation, and this, of course, is a contraindication against operation. Patent ductus arteriosus is also sometimes combined with defects of the ventricular septum, but if only this defect is not too great, these cases can be regarded as similar to the uncomplicated ones from the surgical viewpoint. In one of our cases (case 15) this double anomaly was present.

Due to the fact that the pressure in the aorta after birth is considerably greater than that in the pulmonary artery, contrary to the case in foetal life, the blood in the ductus arteriosus flows in the direction from the aorta to the pulmonary artery. Thus the left ventricle has to eject not only the blood, that is needed to oxygenate the tissues of the body, but also the amount, that is shunted through the ductus arteriosus. EPPINGER and BURWELL, who have determined the amount of blood, that passes through the ductus, by blood-analysis during operations, have found, that no less than 45—75 % of the left ventricular output takes the shortcut through the ductus arteriosus. Thus the left heart has to perform a considerable amount of overwork, whereas the right heart functions under approximately normal conditions. The excessive filling and the chronic overwork of the left heart leads to dilatation and hypertrophy of the left ventricle and auricle. These changes, especially the enlargement of the left ventricle,

can often be recognized on the roentgenogram. The ventricular dilatation is often considerable, but in many cases a rapid return to normal is observed, when the bloodstream through the ductus has been interrupted by an operation (fig. 1).

Thus the increased strain on the left heart is the most important change in patent ductus arteriosus from the viewpoint of heart physiology. This increased strain is doubtless congruent with the amount of blood, that passes through the ductus arteriosus, and in many cases it is so great, that the left heart has to accomplish up to four times greater a work than normal. However, on account of the great cardiac reserve in youth, the patients are often compensated, and the symptoms of heart failure are not encountered until later on in life. Because of the shunted blood being arterial no cyanosis is present so long as the patient is compensated.

The pulmonary blood vessels also have to meet with a greater demand than usual. These blood vessels have to transport not only the normal amount of blood, but also the amount shunted from the aorta. Therefore their calibre augments, which is often recognized in the roentgenogram by increasingly marked blood-vessels in the lung fields.

Table I.

Case	Sex	Age in years at the op
1		
2		
3	Female	7 $\frac{7}{12}$
4	"	15 $\frac{1}{12}$
5	Male	2 $\frac{8}{12}$
6	Female	18 $\frac{7}{12}$
7	"	11 $\frac{6}{12}$
8	Male	28 $\frac{11}{12}$
9	Female	9 $\frac{1}{12}$
10	"	7 $\frac{3}{12}$
11	Male	13 $\frac{7}{12}$
12	Female	2 $\frac{8}{12}$
13	"	9 $\frac{11}{12}$
14	"	3 $\frac{3}{12}$
15	"	5 $\frac{1}{12}$
16	Male	5 $\frac{7}{12}$
17	"	10 $\frac{2}{12}$
18	Female	9 $\frac{7}{12}$
19	"	8 $\frac{8}{12}$
20	Male	6 $\frac{8}{12}$
	"	8
		18 $\frac{2}{12}$

Patent ductus arteriosus seems to be an anomaly occurring more often in girls than in boys. GROSS mentions the proportion 3/2. In the material of BULLOCK, JONES and DOLLEY there are 4 boys and 7 girls. Of our 20 cases 13 were girls (Table 1).

### Symptoms and Signs.

A certain retarded bodily development has been considered one of the commonest general symptoms of patent ductus arteriosus. Two of our patients presented a marked infantilism. One of them (case 3) weighed 8.9 kg. at  $2\frac{8}{12}$  years of age, while his twin sister weighed 12.5 kg. The other (case 16) had a short-weight of 4.5 kg. at  $9\frac{7}{12}$  years of age. Also others among our patients have shown a certain lack of normal physical development, but in these other cases only moderately so. As to the height and weight most of them have varied within normal limits. Thus, it is by no means a rule, that patent ductus arteriosus causes infantilism. The psychical development has been normal in all our cases.

GROSS states that as a rule, the patients have no heart symptoms during the 3 or 4 first years of life. Six of our cases, though, have shown prominent such before three years of age, (cases 1, 3, 8, 9, 14 and 19), such as cyanosis and dyspnoea on exertion. Case 3 also suffered from quite a number of attacks of unconsciousness of short duration, though without convulsions. The onset of the subjective symptoms usually occurs, when the patient reaches the age of three or four years. The affected children usually develop shortness of breath and get tired easier than their playmates. Sometimes there is also present a certain feeling of discomfort in the vicinity of the heart. Symptoms of heart-failure have been observed in 10 of our cases. These symptoms have been shortness of breath and fatigue on only moderate exertion, and some times there has also been a certain degree of cyanosis. The oldest of our patients (case 6, a 29 year old woman) had had quite a few sudden attacks of severe precordial pain combined with discomfort. In addition she had been troubled by slow-healing ulcerations of the legs during the last six years, although she had had no varicose veins and no thrombosis. The Wassermann reaction was negative. The oscillogram was normal. Doubtlessly, these ulcerations must be considered a symptom



due to insufficient blood supply of the legs After the operation the ulcerations healed, and have not appeared since Fifty percent of our cases have been fully compensated at the time of the operation

The width of the ductus, found at the operation, has, in most cases, been congruent with the subjective symptoms The cases, that have shown symptoms of decompensation, have particularly been those with an especially wide ductus This has, however, not always been so, e g in case 7 there were considerable subjective symptoms but an unusually narrow ductus (Table II)

The cardiological examinations have given the following results Voussure was present only in a few cases In almost all cases there was an intense thrill most prominent over the pulmonary orifice This is a consequence of the powerful vibrations of the thoracic wall caused by the murmur On percussion a moderate enlargement of the heart to the left has been found in some of the cases A symptom, that formerly was given a certain consideration in diagnosing patent ductus arteriosus, is the so-called Gerhard's dullness, that is, a dullness in the second intercostal space to the left of the sternum The reason of this dullness is doubtlessly the distended pulmonary arch A strongly developed pulmonary arch, however, is present in only a limited number of cases of patent ductus arteriosus In our cases Gerhard's dullness has been found in three patients (As this symptom is very inconstant in patent ductus arteriosus, our attention has not been drawn towards it in our later cases)

All cases have on auscultation yielded very unanimous results The typical continuous murmur is heard with a maximal intensity over the second intercostal space close to the sternum It is often of great intensity, sawing, and is well characterized in Anglo-Saxon literature by the expression "machinery murmur" Its most important feature is its position in the pulse period It starts in the middle of the systole and fades out in the later part of the diastole By connecting two microphones to an ordinary stethoscope and applying one of the microphones over the apex of the heart and the other over the pulmonary orifice one can satisfy oneself as to this quality of the murmur

On account of its force, the continuous murmur is spread all over the heart, and in many cases, it can easily be heard on the back and over the entire thorax In most cases the murmur is of very great intensity, but in exceptional cases it is less striking,

as for example in our case 20, where there was a direct inter-communication between the aorta and the pulmonary artery

The increased pressure in the pulmonary artery is manifested by an accentuated second pulmonary sound. This accent is not seldom muffled by the intense murmur and thus it is not always to be heard. In seven of our cases a distinctly accentuated second pulmonary sound was heard.

As the left ventricle, at each systole, ejects a considerable greater amount of blood than normal, part of which is shunted from the aorta to the pulmonary artery, a *pulsus altus* can be expected in these cases. This high pulse-pressure with great amplitude of the blood-pressure has often been considered one of the characteristic symptoms of patent ductus arteriosus (LEWICHI). Later casuistics, though (EPPINGER, BURWELL, GROSS), and the results from our own cases have not been able to verify, that this great amplitude of the blood-pressure is a rule. Only eleven of our patients had a pulse-pressure above 50 mm Hg, and if the pulse-pressure is compared with the width of the ductus, measured at the operation, it is found, that the cases with the greatest difference between the systolic and the diastolic blood-pressure, almost regularly, have been those with a particularly wide ductus. Only one patient had a greater pulse-pressure than 50 mm Hg after the operation.

*Pulsus altus* can also be manifested in other ways than by a great amplitude of the blood-pressure, e. g. by capillary pulse and by the so-called "pistol shot sounds" over peripheral arteries. Exceptionally we have been able to establish this phenomenon in our cases. (The physical findings and the different widths of the ductus are compiled in table II.)

In order to find a measure of a latent heart failure if possible, we have determined the circulation time (the decholin method according to WINTERNITZ and associates) and the venous pressure in eight of our cases. EPPINGER, BURWELL and GROSS have found a moderately prolonged circulation time up to 22 seconds in many of their cases. The normal value in children varies from 9—12 seconds (MANNHEIMER). The circulation time in those of our cases, where it has been determined, varies between 6 and 15 seconds. The venous pressure (normal value 10 cm of water) has been normal with the exception of case 1 (16 cm) and case 4 (14 cm).

The roentgenological examination of the heart has attained

Table II.

Case	Voussure	Thrill	Blood pressure before op	Symptoms of decomp	Width of ductus expressed in mm	Blood pressure after op
1	+	+	115/50	+	43	115/80
2	—	+	135/60	—	34	130/90
3	+	+	125/55	+	appr 40	115/80
4	—	+	110/40	+	49	115/75
5	+	+	130/85	—	8	120/85
6	—	+	120/80	+	appr 45	115/75
7	+	+	110/65	+	10	110/80
8	+	+	115/45	+	33	120/85
9	+	+	130/65	+	appr 40	110/90
10	—	+	110/55	—	40	95/60
11	—	+	110/55	—	29	120/85
12	—	+	110/60	—	23	115/70
13	+	+	120/80	—	21	110/60
14	—	+	90/60	+	16	
15	—	+	115/80	—	24	110/90
16	—	+	120/65	+	37	125/80
17	—	—	125/80	—	19	120/80
18	—	—	135/80	—	27	110/80
19	+	+	110/30	—	30	125/85
20	+	+	125/15	(+)	51	120/60

Table III.

Case	Enlargement of the left ventricle	Increased bulging of the pulmonary arch	Central pulmonary congestion
1	+	+	+
2	—	—	—
3	+	+	+
4	+	+	+
5	+	+	+
6	+	+	—
7	+	—	+
8	+	—	+
9	+	+	+
10	+	+	—
11	+	+	+
12	+	+	+
13	+	+	+
14	+	+	+
15	+	—	+
16	+	—	+
17	+	—	—
18	—	—	—
19	+	—	+
20	+	+	+



A few days after operation

Fig 1

Case No I

Before the operation



Fig 4

- a Showing the pericardial flap covering the ductus
- b Showing how the ductus is exposed after careful removal of the pericardial flap
- c Illustrating the method of twofold ligation of the ductus
- d Illustrating the division of the ductus
- e Showing the method applied when the ductus is too short for either division or ligation and thus a small part of the wall of the pulmonary artery is removed together with the ductus

The drawings are made by dr T BJÖRKROTH

great importance in later years, during which these problems have been dealt with. The expression "typical roentgenogram of a patent ductus arteriosus" has even been found in the literature. This typical roentgenogram is supposed to comprise an enlargement of the heart, especially to the left, with bulging contour of the left ventricle, pathologically enlarged pulmonary arch, signs of pulmonary congestion in the central parts of the lungs and pulsations of the hilar vessels, so-called hilar dance. The experience from our material, however, shows, that no such typical roentgenogram exists. In exceptional cases the roentgenological examination has even shown perfectly normal or almost normal conditions. In most cases, though, an increased bulging of the left ventricular contour has been observed and in somewhat more than 50 % of the cases the pulmonary arch has been larger than normal. In all cases except five there has been signs of central pulmonary congestion. In some of the cases, though, this congestion has been inconsiderable. "Hilar dance" has been present only in exceptional cases of our material. The roentgenological findings are compiled in table III.

The electrocardiograms in our cases have presented only slight pathological changes. BULLOCK, JONES and DOLLEY demand, that the electrocardiograms be next to normal to allow the diagnosis uncomplicated patent ductus arteriosus. As the anomaly is extracardial, one might expect, that the changes in the electrocardiogram should be secondary phenomena. In one patient only (case 3), there has been a moderately prolonged conduction time (0.19 sec.), in the rest the conduction time was normal. In 16 of the cases the direction of the electrical axis was normal. In 2 cases (cases 2 and 7) there was a slight right axis deviation, and in 2 cases (cases 9 and 15) a slight left axis deviation. In 4 patients there were slight changes of the S—T segments, and in 1 case (case 20) there were more pronounced alterations in this segment, suggesting secondary damage of the myocardium. (The electrocardiographic findings are compiled in table IV.)

All cases have been examined phonocardiographically by calibrated phonocardiography (MANNHEIMER). In fig. 2 there are illustrations of phonocardiograms before the operation as well as after. In all the cases, the registration has been made with the microphone placed in the second left intercostal space close to the sternum, where the murmurs have had their maximal intensity in all the patients. The phonocardiograms exhibited

Table IV

Case	P—Q interval	Deviations of the electrical axis	Other deviations from the normal
1	0 13	none	Occasional extrasystoles
2	0 19	right	
3	0 13	none	The S—T segments slightly depressed in Lead II
4	0 17	"	The S—T segments depressed in Lead II
5	0 16	"	
6	0 15	"	The S—T segments very slightly elevated in Lead I
7	0 18	right	
8	0 16	none	
9	0 18	left	
10	0 13	none	The S—T segment curved in Leads I and II
11	0 11	"	
12	0 13	"	
13	0 13	"	
14	0 17	"	
15	0 13	left	
16	0 16	none	
17	0 12	"	
18	0 14	"	
19	0 15	"	
20	0 15	"	The S—T segments depressed in Leads I and II

rather uniform values, both as regards the frequency and amplitude of the murmur. The most characteristic feature of the continuous murmur is its position in the pulse period, the determination of which is facilitated by simultaneous registration of the electrocardiogram. The murmur commences a short while after the beginning of the systole, as is seen in fig. 2, it has its maximum around the 2nd heart sound, that is often imperceptible because of the murmur, and it weakens far into the diastole. The murmur is often very loud, and the continuous murmur is one of the very loudest cardiac murmurs. In measuring its strength by measuring the greatest amplitude within each frequency range, the following results have been obtained (Table V).

As has been shown previously (Mc KLE, MANNHEIMER), there is a faint systolic murmur in almost all normal cases. The amplitude of the continuous murmur does not fall within the limits of that of the normal systolic murmur and all the values are far beyond the normal range. A comparison of the group of murmurs in the congenital anomalies of the heart with the con-

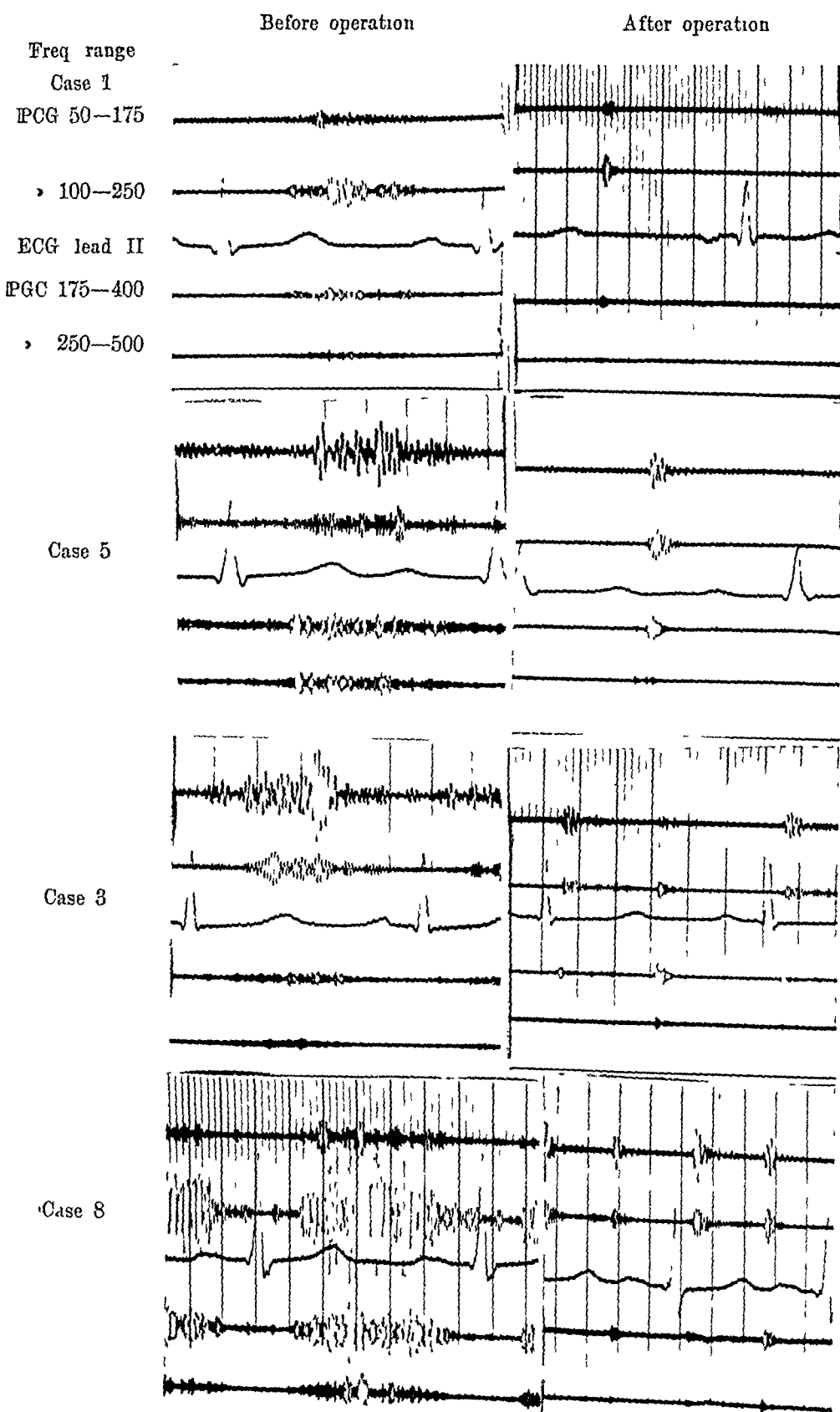


Fig 2



Table V.

*The amplitude of the murmur in 135 normal cases, 90 cases of congenital anomalies of the heart and 15 cases of patent ductus arteriosus, expressed in dynes/cm<sup>2</sup>*

$n$  = number of cases  $M$  = mean  $\epsilon(M)$  = standard error of the mean  
 $D$  = difference  $\epsilon(D)$  = standard error of the difference

Frequency range	Normal cases			Congenital anomalies of the heart			Continuous murmurs			Difference	
	$n$	$M_1$	$\epsilon(M)_1$	$n$	$M_2$	$\epsilon(M)_2$	$n$	$M_3$	$\epsilon(M)_3$	$D(M_3 - M_1) \pm \epsilon(D)$	$D(M_3 - M_2) \pm \epsilon(D)$
0-100	135	5.12	$\pm 0.40$	90	15.8	$\pm 3.1$	15	47.7	$\pm 12.6$	$+ 39.6 \pm 12.6$	$+ 32.4 \pm 13.0$
50-175	135	0.41	$\pm 0.06$	90	32.8	$\pm 3.6$	15	45.9	$\pm 6.5$	$+ 45.5 \pm 6.5$	$+ 13.6 \pm 7.4$
100-250				90	4.56	$\pm 0.56$	15	5.52	$\pm 0.88$		$+ 0.96 \pm 1.0$
175-400				90	1.37	$\pm 0.19$	15	1.03	$\pm 0.16$		$- 0.34 \pm 0.2$
250-500				90	1.04	$\pm 0.23$	15	0.51	$\pm 0.08$		$- 0.80 \pm 0.24$

tinuous murmurs in the 15 cases of patent ductus arteriosus shows the following facts. Within the lowest range of frequency there is a statistically probable difference in the respect, that the amplitude of the continuous murmur shows a higher value. In the frequency range of 250-500 cycles per second conditions are reversed, that is, here the amplitude is greater in the groups of other congenital anomalies. The difference has been statistically confirmed. One can hereby draw the conclusion, that the continuous murmur consists of very strong vibrations of low frequency. Considering the mechanism of origin of this murmur, however, this fact will not cause any surprise. The continuous murmur is produced, when the bloodstream, rushing into the pulmonary artery, there encounters the blood from the right ventricle giving rise to powerful whirls. These are probably the cause of the loud continuous murmur of low frequency. In contrast hereto, there are the systolic murmurs in other congenital affections of the heart the high frequencies of which are due to stenoses of the blood paths (pulmonary stenosis, septum defects). *Thus the continuous murmur in patent ductus arteriosus is phonocardiographically characterized by its typical position in the pulse period, its great force within the lower ranges of frequency and by its maximal intensity over the left second intercostal space close to the sternum.*

With the purpose of differential diagnosis, the phonocardiograms from a case of septum defect with a systolic murmur (3a), one case of aortic regurgitation of luetic origin with a systolic

and a protodiastolic murmur (3b), and one case of patent ductus arteriosus with a continuous murmur (3c), are shown in fig 3. The systolic murmur in fig 3a as well as the one in fig 3b, shows vibrations in direct connection with the first heart sound, and is concluded by a distinctly separate second sound. In fig 3b the protodiastolic murmur is seen after the second sound. The phase of the continuous murmur in 3c however, is displaced, as compared to systole and diastole.

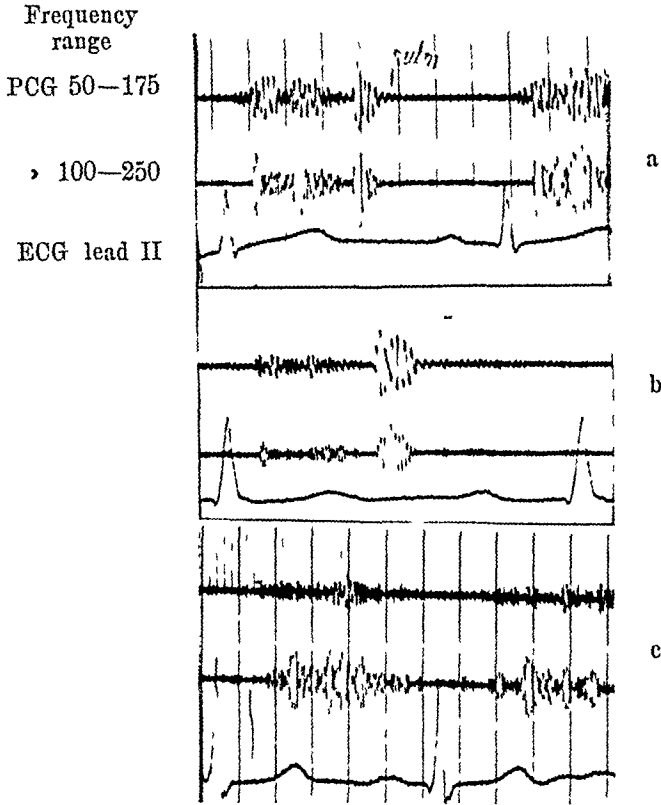


Fig 3

- a Systolic murmur in a case of ventricular septal defect
- b Systolic and protodiastolic murmur in a case of aortic regurgitation of the aortic valve
- c Continuous murmur

### Diagnosis.

The most important finding at the examination, which leads to the diagnosis, is the continuous murmur, the characteristics of which have been related above. As will be shown later on, continuous murmurs over the heart can also exist in diseases

other than patent ductus arteriosus. Thus this symptom in itself cannot be regarded as pathognomonic, but a continuous murmur, with its maximal intensity over the left second intercostal space close to the sternum is not produced in any other anomaly of the heart. Herein then, lies the key to the diagnosis, which is confirmed by the electrocardiogram, which is normal or next to normal and by the above discussed changes in the roentgenogram, which are present in many cases. The anomaly seems to be commoner in girls than in boys. A certain retarded physical development and signs of heart failure are found in certain cases but are by no means always present. A high pulse-pressure can often be found, but a normal difference between the systolic and the diastolic blood-pressure does not contradict the diagnosis.

As the diagnosis of patent ductus arteriosus is based mainly on the presence of a continuous murmur, the questions arising at a differential diagnosis will be the following

- 1 In what other conditions do continuous murmurs exist?
- 2 Can patent ductus arteriosus exist without the continuous murmur?

WHITE states, that a continuous murmur often is to be heard in the neck of normal persons, mostly to the right. This sound phenomenon is caused by the venous afflux to the jugular bulb. In exceptional cases, this murmur can be heard closer to the region of the heart, but it is faint and should not give rise to diagnostic difficulties. In addition, a continuous murmur can be heard on auscultation over arteriovenous anastomoses in general, e. g. arteriovenous aneurysms and in Moirbus Basedow, but they do not cause any problems as regards the diagnosis of patent ductus arteriosus. Finally it occurs in a rare kind of congenital heart affection, known as congenital arteriovenous aneurysm, but in this disease the murmur always has its maximum over the aortic orifice to the right of the sternum. We have not been able to find any data in the literature implying that a continuous murmur could be present in conditions other than those mentioned above. However, we are in the position to present two cases of persisting truncus arteriosus communis with continuous murmur.

One of the cases is a girl of somewhat more than 4 years of age, who was found to suffer from an anomaly of the heart at a medical examination at 6 weeks of age. Even on very moderate exertion she

experienced violent palpitation and grew tired easily, but she had no cyanosis. She showed signs of a considerably retarded physical development. On physical examination of the heart a conspicuous *voussure*, a thrill and a loud continuous murmur with its maximal intensity over the 3rd intercostal space was found. The blood-pressure was 85/25. The roentgenogram presented increased bulging of the left ventricular contour but no enlargement of the pulmonary arch and no pulmonary congestion. The electrocardiogram showed only slight changes. The phonocardiogram verified, that it was a continuous murmur with its maximal intensity over the 3rd left intercostal space. Due to the continuous murmur a patent ductus arteriosus was suspected, but as its maximal intensity was not over the pulmonary orifice, the diagnosis was uncertain, and an exploratory thoracotomy was suggested. At the operation a persisting truncus arteriosus communis was found.

The other case is a 13 year old Norwegian boy, whose anomaly was already discovered soon after birth. He developed normally and showed no signs of heart failure. When he was 12, however, he had a small haemoptysis, as a result of which a thorough examination was made in a hospital. The physical findings from the heart were a slight *voussure* and a loud "machinery murmur" most prominent over the 1st sternocostal junction. The roentgenogram showed a hypertrophy to the left of the heart with an increased bulging of the left ventricle and a bud-like protrusion to the left from the inferior part of the aortic arch. The electrocardiogram showed slight coronary incompetence. The phonocardiogram verified the auscultatory findings. Thus, the symptoms did not altogether correspond to those of a patent ductus arteriosus, but all the same this diagnosis was so highly suspected, that a thoracotomy was considered indicated. The operation showed a persistent truncus arteriosus communis (The protrusion of the aorta, observed on the roentgenogram, corresponded to an aneurysmatic protrusion at the bifurcation of the truncus).

These two cases illustrate that a continuous murmur over the heart can be present in persisting truncus arteriosus communis. The maximal intensity of the murmur in these cases, however, is not over the left second intercostal space close to the sternum but over other parts of the praecordium. Therefore it is most important to insist, that the continuous murmur must be of maximal intensity over the site of the pulmonary orifice, before the diagnosis patent ductus arteriosus is arrived at conclusively.

The other question to be answered was, if a patent ductus arteriosus could exist without a continuous murmur. ABBOTT states, that infants and young children can present a pure systolic murmur as a symptom of patent ductus arteriosus. At this age, however, the frequency of the heartbeats is so great, that it is doubtful, if a strong systolic murmur and a continuous murmur

can be distinguished from each other. Cases of less than 1 year of age are also difficult to interpret phonocardiographically because the diastole usually is of very short duration at high frequencies of the heart, and the phase displacement difficult to establish.

One congenital anomaly of the heart, that is congenital dilatation of the pulmonary artery, presents a similar symptomatology to that of patent ductus arteriosus in many respects, but differs from the latter in that the murmur is purely systolic. We have had a patient, who suffered from this anomaly and who presented certain symptoms of interest for the differential diagnosis, and we will therefore give a brief account of this case. It was a woman, aged 18, whose anomaly had been diagnosed, when she was 1½ years old. She developed dyspnoea and grew tired on only moderate exertion but had no cyanosis. Over the heart a very loud systolic murmur was heard with its maximal intensity over the pulmonary orifice. The blood-pressure was 115/65. The roentgenogram showed an increased bulging of the pulmonary arch, and in the electrocardiogram there was a relative right axis deviation. The phonocardiogram coincided with the auscultation. Thus many symptoms were found here, that coincided with those in patent ductus arteriosus, but there was no continuous murmur. Consequently the diagnosis was uncertain, but a patent ductus arteriosus was so strongly suspected, that an exploratory thoracotomy was suggested, especially as congenital pulmonary anomalies without cyanosis are very rare. The exploration showed a violently dilated pulmonary artery but no patent ductus arteriosus. This case shows, that one must not forego the demand of a continuous murmur when establishing the diagnosis patent ductus arteriosus, even if many other signs suggest it.

Thus, the question, if a patent ductus arteriosus can exist without a continuous murmur, must be denied with the exception of the first year of life.

### Prognosis

BULLOCK, JONES and DOLLEY say, that the prognosis is good from a pediatric viewpoint. Most of the patients suffering from this anomaly lead a relatively unmolested life during the time, that they belong to the clientage of the pediatrician, and they do

not develop serious symptoms of their heart affection until later on in life

ABBOTT has made the classical investigation on the prognosis in patent ductus arteriosus on an autoptic material comprising 92 patients 20 of these died during the neonatal period The average age of death was 24 years

The cause of death in the cases, that died of a heart affection, was either bacterial endocarditis, decompensation or sudden cardiac failure Approximately  $\frac{1}{3}$  of the patients died of causes unrelated to the heart BULLOCK, JONES and DOLLEY have criticized ABBOTT'S results, and as it seems rightly so, saying, that the 20 cases, that died in infancy, should be excluded from her material, firstly, because the cause of death at this age often must be considered dubious, secondly, because they cannot be reached by therapeutics and thirdly, because the presence of a patent ductus arteriosus of this age cannot always be considered abnormal

BULLOCK, JONES and DOLLEY have collected 80 cases from the literature, that have lived more than 3 years, that is, such patients as are of interest from the viewpoint of surgical therapy. On analysing this material it is found, that 50 % died before the age of 30 and 71 % before the age of 40 Two patients lived to be 66, but they had been disabled by their heart affection for quite some time before death In 87 % of the cases the cause of death could be traced to heart affections (bacterial endocarditis, cardiac decompensation, sudden failure, rupture of the ductus etc ), while 7 % of the cases died of other causes In 6 % of the cases the cause of death was unrecognized From this it is evident, that the prognosis *quod vitam* must be considered as bad In addition, these patients probably suffered from considerable heart trouble a long time before death, whereby their capacity for work was appreciably reduced A reliable prognosis cannot be established in each separate case with our present cognizance Above all, it is impossible to foresee, what patient will and what patient will not suffer from considerable inconveniences from his anomaly later on in life However, if signs of cardiac decompensation are present already in youth, one is entitled to estimate the prognosis of this special case as bad

### Indications for Operation.

On evaluating the indications for operation, one must, as is readily understood, take the following facts into consideration 1 the prognosis of the non-operated cases, 2 the mortality of the operation and 3 the post-operative prognosis of the operated cases

As regards the first point, one cannot, as mentioned above, determine the prognosis of the separate case, but one has to refer to the above related compiled statistics These give a frightening outlook as to the prognosis, presenting an average length of life of 24 years (according to ABBOTT) and 50 % dead before 30 (according to BULLOCK, JONES and DOLLEY)

The cases, that have not been infected at the operation, and those complicated by a bacterial endocarditis, must be differentiated, when estimating the risk of an operation in the individual case Our own experiences refer only to the non-infected cases According to references available to us 60 "non-infected" cases (including our own) have been operated upon so far Three of these have died as a result of the operation One of the latter was operated upon by GROSS, and here the cause of death was wound infection The second case has been accounted for by BULLOCK, JONES and DOLLEY At the autopsy an aneurysmatic protrusion of the ductus area with a communication between the aorta and the pulmonary artery through the aneurysm was encountered here In addition, there were septic changes present, apparently originating from the aneurysm Probably, the primary cause of the unfortunate ending of this case was, that the ligature had perforated the ductus secondarily This case illustrates the risk of ligating the ductus, when the wall is brittle (see below) The third fatal case belongs to our series In this case, the cause of death could not be established with certainty (an account of this case will be given further on) Thus concerning the non-infected cases, an operation mortality of 5 % is obtained, a number which must be considered low, when considering the fact, that it refers to a disease with so unfavourable a prognosis if not subjected to causal treatment

A matter of great importance is, if there is any risk in hand for relapse after an operation The cases operated so far have only been observed for a relatively short time so the question of re-

lapse frequency cannot yet be answered conclusively. The method applied when attending to the ductus and the operative technique on the whole are undoubtedly of great importance for the possibility of eventual recanalization. So far three relapses are known of. These cases have been operated by GROSS, HUMPHREYS and HULTÉN. In at least two of these (the cases of HUMPHREYS and HULTÉN) the ductus was closed in a way, that we do not consider as sufficiently radical, that is by a simple ligature and by two closely applied ligatures respectively. HUMPHREYS reoperated his patient with a good result and HULTÉN's patient has no subjective symptoms in spite of the recanalization. Among our patients, none has so far shown any signs of relapse. With a suitable technique the risk of relapse seems to be minimal.

When it comes to judging the late prognosis one still finds oneself on unknown premises. However, there is reason to believe, that if the patients do not have a relapse, they are definitely restored from the risk of developing the complicating diseases, to which patients with patent ductus arteriosus often have succumbed when still quite young.

Also a question of social nature is of interest when judging the indications for operation. These patients usually present very striking physical signs of heart-disease, and as a result of which they can never obtain a health-certificate. Thus, they become disqualified, when applying for such posts as require a health-certificate. Our case 4 is a "social case" of this nature, where employment at the post-office department had been refused the person in question, on account of organic heart-disease. After the operation, however, she was accepted.

Concerning the non-infected cases our view so far is, that they should all be operated upon. This opinion of ours, we consider justified by the bad prognosis in the non-operated cases, the relatively low mortality of the operation and by the definite cure, that the operation with all probability offers.

At what age should the operation be performed? In order to avoid such complications as bacterial endocarditis, considerable hypertrophy of the heart and others, as far as possible, the operation should be made already in early childhood. Infancy is not suited for operative procedures of this kind and if intubation narcosis is used during the procedure (which we consider the only proper course of action), one should wait until the patients attain the age of 3, when the trachea has grown large enough to allow



the use of a tube so wide as not to hazard proper ventilation of the lungs. The age of our patients has varied from 2  $\frac{3}{4}$  s to 29 years. Most of them have been operated upon at an age of less than 10. During the operation of our youngest patient, the lung ventilation was barely sufficient, because we had to employ such a narrow tracheal tube.

Concerning cases of patent ductus arteriosus, complicated by sepsis, we do not have any experience of our own but references show, that the operation risk is considerably greater in these cases, and that the results from therapeutical viewpoint are more insecure. 18 cases have been published (STRIEDER 1 case, HUMPHREYS 6 cases, and TOUROPF 11 cases). 2 of these died of uncontrollable hemorrhage during the operation and 2 died of sepsis a short time after the encroachment. Of the surviving, 9 have apparently recovered from the sepsis, while in 4 cases the operation has had no definite effect on infection. One patient had been operated upon quite recently at the publication time, for which reason the result in this case is unknown.

These patients suffer from a disease, presenting a prognosis pessima, and therefore it seems to be well worth trying operative treatment, as it seems possible to save some patients by this means.

### Operative Technique.

In 1939 Gross described his operative technique, and there is reason to believe that most surgeons have followed Gross' instructions to a great extent at their operations. We will here give a brief description of Gross' technique. The patient is operated upon in general anaesthesia, placed on his back on the operation table, with the left shoulder pushed forward by a small sandbag, placed beneath the shoulder, and with his left hand extended up along the head. The skin incision is made transversely in the 3rd intercostal space from the sternum to the mid-axillary line. When the musculature has been divided, an incision is made into the 3rd intercostal space and in order to facilitate dilatation of the incision, the third, and if necessary, also the second costal cartilage is cut across. The lung collapses at the thoracotomy and is pushed downwards, so that the upper part of the mediastinum can be surveyed. The mediastinal pleura is

incised longitudinally over the aorta and the pulmonary artery, a few cm behind the phrenic nerve. Then, in order to locate the ductus arteriosus, Gross makes use of, firstly, the recurrent laryngeal nerve, that leaves the vagus nerve immediately behind the ductus arteriosus and then passes up between the aorta and the pulmonary artery, and secondly, the palpation of the thrill. After the ductus has been carefully released from surrounding tissue, it is occluded for some time, during which cardiac action, pulse and blood-pressure are closely observed. Then the ductus is ligated in two places with an interstice of a couple of mm. A few drops of an intima-destroying fluid are injected into this interstitial lumen.

The technique of BULLOCK, JONES, and DOLLEY chiefly corresponds to that of GROSS', but they apparently use only one ligature with a double thread and HUMPHREYS evidently only makes one ligature with a single thread.

An inherent drawback of GROSS' technique is the short incision. With this short incision, the operator must work at a considerable depth and within a rather confined space, from which follows for instance, that a complicating hemorrhage from the ductus might be very difficult to master. Thus, TOUROFF lost two patients on account of operative hemorrhage.

It must be considered repudiable to make only one ligature of the ductus, like some operators do. As is well known from the surgery of other blood vessels, it is not sufficient to apply only one ligature to a large artery, as recanalization is then likely to occur. This has probably happened in HULTÉN's, in one of HUMPHREYS' and in one of GROSS' cases. Twofold ligature on the other hand, preferably combined with the injection of an intima-destroying fluid between the ligatures, seems to prevent recanalization. In some cases, however, where the ductus is very short and relatively wide, or where its wall is very brittle, it is not possible to apply ligatures, as these would perforate the wall on the very strong tightening, which is necessary. Under these circumstances, dividing of the ductus and providing both stumps with sutures is the only method, that can be taken into consideration. The first one to divide the ductus seems to have been CRAFOORD, who, when operating his first case (May 1941), divided the ductus and provided for the stumps by applying blood-vessel sutures. TOUROFF has since given account of two cases, in which the ductus has been divided.

Thus, in providing for the ductus, one can choose one of the two procedures, ligation or division

1 *Ligation* If ligation is to be made, it should be twofold on account of the reasons mentioned above. One reason for ligating in suitable cases is, that it is technically easier and considerably less time-wasting than is division. Against ligation can be advanced, that relapse may follow, and even though thick ligature material is used, the ligature might perforate the wall of the ductus, which is often brittle, thus causing a hemorrhage very difficult to control. In one of our cases (case 9) the ductus ruptured on tightening of the ligature. The circumference of the ductus was in this case some 40 mm, the long slide measured 3 and the short one 1 mm. The ligature (silk no. 4) cut through, and a violent hemorrhage from the pulmonary artery, as well as from the aorta, ensued. The hemorrhage from the holes in the aorta and the pulmonary artery, that were about as wide as a little finger, was temporarily arrested by digital compression, and then the dissection was carried on all around the aorta, above as well as below the ductus, and the aorta was shut off with soft clamps. Then a side-clamp was applied to the pulmonary artery, preventing hemorrhage from this vessel, but in such a way, that part of its lumen was left open for blood transit. The hole in the pulmonary artery was then sutured. While the hole in the aortic wall was plugged, using a finger as tampon, the clamps on the aorta were released for a couple of minutes so that the blood circulation in the lower and central parts of the body would not be shut off too long. After a couple of minutes the clamps were compressed again, and then the defect in the aortic wall was closed by a row of continuous blood vessel sutures, and on the outside of these, a row of isolated sutures, invaginating the first row. The aorta was shut off for 25 consecutive minutes (naturally caudally to the departure of the left subclavian artery). The patient lost a great deal of blood during the procedure, but this was replaced by repeated blood transfusions during the operation. The patient remained in a good state throughout the entire operation, and the post operative course was uncomplicated. The long-lasting closure of the aorta apparently had no deleterious effects, not even on the large parenchymatous organs. At repeated postoperative examinations of the urine, no albuminuria or pathological sediments were encountered. On the other hand, the urine the first days after operation contained rather a large

quantity of urobilin, which doubtlessly must be regarded as a sign of impaired liver-function, due to the lengthy arterial anemia.

The cases best suited for ligature are naturally those, where the ductus is relatively long, and of a small calibre. This has also been the case in most of our ligated patients. In some of the cases, where ligature has been applied, (cases 12, 13, 17, 18, and 19), even though the ductus was rather short, the ductus has been "elongated" thus the aorta and the pulmonary artery have been separated carefully, by which procedure the ductus has pulled out the pulmonary wall to a small nozzle and around this nozzle one of the ligatures has been placed. The ligature has never encroached upon the lumen of pulmonary artery to any noteworthy extent. Silk (nos 4 or 5) has been used as ligature material.

Twelve of our cases have been treated with twofold ligature, and in all these cases a few drops of a 50 % solution of glucose were injected into the lumen between the ligatures.

Among these twelve patients one fatal case occurred, and as the cause of death here surely could not have depended on the operative technique, but is still doubtful, we consider it justified to give a more detailed account of this case.

It was here the case of a girl, a little short of 6 years of age, who presented a usual case-history of patent ductus arteriosus, and who was of good general condition on the occasion of the operation. At the operation a relatively narrow ductus was found (circumference 16 mm), 4 and 3 mm long respectively. A twofold ligature was applied in the usual manner and the operation was completed unusually quickly. As soon as the spiropulsator was disconnected, she started to breathe spontaneously. She received a small blood transfusion (200 ml heparin blood) and about 5 minutes later the trachea was sucked clean with a rubber catheter, introduced through the tracheal tube. In connection hereto, the patient became pulseless, and developed a poor colour. No heart sounds were audible. The wound was reopened and heart massage was started.  $\frac{1}{2}$  ml of adrenaline was administered intracardially. The heart soon started to work again and the blood-pressure shortly rose to normal. The pupils, that had been maximally dilated, contracted again. For how long time the heart arrest lasted, is unclear, but most likely, the heart activity was extinguished for more than five minutes. Afterwards the patient was paraplegic, agitated, and had attacks

of clonic spasms Without having regained conscience, she died 48 hours after the operation At the autopsy nothing remarkable was found except for some hardly distinct ischaemic alterations of the cerebellar ganglia here and there Death had evidently been caused by the fact, that the blood circulation of the brain had been interrupted too long The inducement of the heart arrest is unclear A test examination of the blood of patient and donor revealed, that they belonged to the same blood group The heart arrest may possibly have been induced by way of a reflex, caused by the rapidly produced negative pressure in the trachea on suction through the tracheal tube The fact is, that violent changes of pressure have proved capable of causing sudden death, e g of persons present in the vicinity of an exploding bomb, who have not met with any external injury but only been exposed to the great pressure change, induced by the pressure wave emitted at a powerful explosion Hereby, the negative phase, that is the suction phase, is just as dangerous as the positive pressure wave, according to English experimental investigations

2 *Division of the ductus* To divide the ductus arteriosus, providing for the stumps by applying blood vessel sutures, is naturally to be preferred to ligation from the viewpoint of eventual relapse One might therefore say, that this alternative should be chosen if possible, when operating a patent ductus arteriosus This operation method, however, takes a much longer time and requires a considerably greater technical skill on the part of the operator, than does ligation, therefore twofold ligation must be considered a justifiable procedure in many cases (see above)

In what cases should a division of the ductus be made? First of all the ductus should be divided in the cases, where an attempt to ligate probably will be combined with the risk of the ligatures cutting through Thus, such patients belong in this group, that have either a short and wide ductus or an apparently brittle ductus wall Division is probably the most suitable method also in those cases, that have a remarkably wide ductus, even if its length should permit a twofold ligation, as one has reasons to suspect that the cases of great calibre should be the ones most often subjected to relapses after ligation From the technical viewpoint two different methods have been applied, according to the circumstances In the cases where the ductus has been long enough, a clamp has been applied to the base of the ductus

at the aorta and another to its base on the pulmonary artery. After the ductus has been divided between the clamps, the incision areas have been closed by applying blood vessel sutures. Then, on removing the clamps, coarse silk ligatures have been placed between the sutured incision areas and the large vessels, close to the latter. These ligatures have not been tightened maximally, but only so much, that no blood could enter the blind sack. These ligatures have the double purpose, of preventing too great a strain to be thrown on the blood vessel sutures and of preventing the development of an aneurysm. To make this method applicable, the ductus should be of at least 10 mm. length. 3 patients have been operated according to this method (cases 1, 2 and 4).

Where the ductus has been too short to allow the application of the method related above, one has proceeded in the following manner. After a clamp has been applied to the ductus at the aorta, another one has been placed on the pulmonary artery, embracing the base of the ductus, but leaving part of the lumen of the artery open, so as to allow the transit of blood. The base of the ductus has then been cut out from the pulmonary artery. After this, the hole has been closed by a continuous blood vessel suture, as has also the section area on the ductus arteriosus. Finally a ligature has been placed round the base of the ductus quite close to the aorta. Three patients have been operated according to this technique (cases 6, 11 and 16).

Two more patients belong to the group of cases, that must be included in the divided ones. Case 9, where the ligature perforated, has been described above. In one of our patients there was no developed ductus, but instead the aorta and the pulmonary artery were placed close together with a direct intercommunication of 51 mm's circumference. It is evident, that none of the methods described above could be employed in this case, instead one had to proceed as follows. After the area of the vessel communication had been carefully exposed, clamps were placed on both the aorta and the pulmonary artery, maintaining sufficient lumen outside of the clamps. The area of the communication was divided thus, that a small "foot" could be brought over to the side of the aorta from the wall of the pulmonary artery, this being done to prevent the forceps on the aorta from slipping. Then the holes both on the aorta and the pulmonary artery were closed. To the aortic side a continuous silk suture was sewn,

and outside this suture row, a couple of mattress sutures were applied as reinforcement. The intention had been to close the hole in the pulmonary artery with a continuous silk suture, but as the posterior wall of the pulmonary artery had been partly drawn into the clamp, so that one could not get a proper hold of this wall with the needle, the section area had to be closed by isolated sutures. This situation had to be performed during a very embarrassing hemorrhage, since one was compelled to remove the clamp, and prevent too extensive a blood flow by digital compression of the slit in the pulmonary artery, while the sutures were applied. The different methods applied in dealing with the ductus are illustrated by the drawings in fig. 4.

A detailed description of the technique applied in our operations is given below. All cases have been operated by CRAIJOORD.

Before the operation, morphia and scopolamine are administered to the patient. When he arrives at the operating-theatre an intravenous permanent drip is applied to a vein of one of the ankles. The main object of this permanent drip is, that one may promptly administer stimulants during the operation, if necessary. If indication for a blood transfusion should arise, the blood is infused through the permanent drip. Thus the applying of the permanent drip is to be regarded as a prophylactic measure.

The patient is placed on the operation table on his right side, with his left arm fixed in an armsupporter, at an anteflexion of  $90^{\circ}$ .

The form of anaesthesia used, has been narcosis by inhalation through a tracheal tube. To make the intubation possible, a light cyclopropane anaesthesia has been administered to the youngest patients. In the older ones, the pharynx, larynx, and the upper parts of the trachea have been anaesthetized with 2 % pantokain.

The anaesthetic consisted of a mixture of cyclopropane, nitrous oxide and oxygen. To mixtures of nitrous oxide and oxygen 10—20 % of cyclopropane have been added, the oxygen content has never been less than 25 %. The gas mixture has been distributed to the lungs by rhythmic insufflation during the inspiratory phase and during the expiratory phase the gas has been allowed free efflux, this being attained by the use of the so-called spiropulsator, indicated by FRENCKNER and CRAIJOORD. As the ventilation of the lungs is effected automatically and rhythmically by the spiropulsator, the spontaneous respiration of the patient is entirely disconnected. As a consequence hereof, the thorax

does not move and also the diaphragm remains stationary, which enables the operator to perform his task without the disturbances, that the respiratory movements would induce

After having opened the thoracic cavity, novocain has been injected into the upper intercostal nerves, the sympathetic trunk, the vagus nerve and the phrenic nerve. Hereby it has been possible to reduce the anaesthetic depth

So that the operator may work under as favourable conditions as possible, it is most important to make an incision, that allows a good survey of and an easy accession to the operation area. In all cases the same incision has been used, that is, the one employed by CRAFOORD in other extensive intrathoracic procedures and which is described in detail in his doctor's thesis. The skin incision has been made over the fifth left rib from the osseocartilaginous border to a point closely behind the costal angle, with a rounded turn downwards past the inferior angle of the scapula. After the inferior part of the trapezius muscle, the entire musculus latissimus dorsi and part of the musculus serratus anterior have been divided, a strong cotton tape is sewn round the inferior angle of the scapula with the aid of a coarse suture-needle. By pulling the cotton tape, the scapula can be very much abducted and this abduction is retained by stretching the cotton-tape across the armsupporter and fastening it to the operation table. Then the fifth rib is resected subperiostically from the osseocartilaginous border to the costal angle. The periosteum is removed very carefully from the rib, as it is important, that it be as uninjured as possible at the closure of the wound. The pleural cavity is opened within the entire area of costal resection. The incision can now easily be dilated and this dilatation is retained by a catch. Thus a very good access is obtained to the contents of the left half of the thorax. The superior lobe is compressed with a towel and an excellent view is obtained of the superior part of the mediastinum, the contents of which are now easily accessible to the operator, on account of the large incision.

The mediastinal pleura is divided lengthwise over the aorta and the pulmonary artery down to the hilus, about one cm behind the phrenic nerve. By palpating the thrill and by the situation of the recurrent laryngeal nerve, the ductus arteriosus is located. As a rule the thrill is felt most intensely over the ductus itself and over the pulmonary artery at the place, where



the ductus opens into it, but it is often felt all the way along the main stem of the pulmonary artery to the semilunar valves at the orifice. Mostly there is no thrill over the aorta. In a couple of our cases, though, a slight thrill has been felt over the aorta, just where the latter has been in contact with the pulmonary artery.

The release of tissue around the ductus must be made with great care, because firstly, the wall of the ductus may be very brittle and easily wounded, and secondly, damages to the recurrent nerve must be avoided. As is well known, the recurrent nerve is very sensitive to injury and many cases of post-operative paresis of the recurrent nerve have been described. In one of our cases (case 11), we observed post-operative paresis of the left recurrent laryngeal nerve, which, however, subsided later on. A flap of the pericardium, though, always passes up across the ductus and this pericardial flap must be isolated before ductus proper is encountered. When the ductus has been dissected free from surrounding tissue, its length and width are measured, after which it is temporarily obliterated by applying a soft clamp. During this period of obliteration, that should be continued for at least three minutes, the heart action is closely observed and the pulse and blood-pressure are controlled at short intervals. In some of our cases, the systolic blood-pressure has increased somewhat during this closure, in one of the cases no less than 60 mm. This increase of blood-pressure, however, has been of short duration and it has returned to normal within a few minutes. Evidently this increase of blood-pressure is due to the suddenly augmented blood content of the aorta on obliterating the ductus. If the circulation is not affected by obliterating the ductus, the ductus is provided for according to the principles outlined above. Then the slit in the mediastinal pleura is closed and when the superior lobe of the lung, which is rendered atelectatic by the compression, has recovered its normal air-capacity, which is affected by increasing the insufflation pressure, the thoracic wall is closed by suturing the different layers of the chest in the order of their sequence according to CRAFOORD's method. When the pleural cavity has been closed, the spiropulsator is disconnected and the patient starts to breathe normally again. The tracheal tube is removed, when the spontaneous respiration is perfectly satisfactory.

The duration of the operation has varied within rather wide

limits, especially depending on, if ligation or division of the ductus has been performed. Besides, other circumstances have also influenced the duration, such as the nature of the tissue between the aorta and the pulmonary artery. In some cases this tissue has been very tough and presented signs of inflammatory changes, then having prolonged the time needed for the dissection. The operation has lasted for about 2 hours, when the ductus has been ligated, and for 3—4 hours when divided.

By using a lenient method of anaesthesia, like the one described above, the operator need not think of finishing the operation swiftly, instead he can take his time to release and provide for the ductus, which often requires great technical skill. Our patients do not appear to have been greatly influenced by the narcosis, though it has often been rather long lasting.

The post-operative development has not caused any trouble (with the exception of case 14, where death ensued 48 hours after the operation). As a rule, the post-operative reaction has been very moderate with an increase of temperature up to  $38^{\circ}\text{C}$  in the days immediately after the operation. In almost half of the cases a moderate pleural effusion developed in the left pleural cavity. In some cases this effusion was evacuated, but it was never infected, nor has it exceeded 500 ml. Two patients developed total post-operative atelectasis of the left lung. In one of these, the atelectasis appeared on the third day after the operation. After bronchoscopic drainage, the lung once more contained air, but two days later it was again totally atelectatic. This latter atelectasis, however, dissolved spontaneously after 24 hours. The atelectasis in the other case dissolved spontaneously after a couple of days. There are no former references as to the existence of postoperative atelectasis. Our being able to discover this complication possibly depends on the fact, that as a matter of routine, we have made frequent post-operative roentgenogram controls of the thorax, sometimes repeatedly during the day. It is very possible, that we would otherwise have overlooked the occurrence of this atelectasis, especially as it seemingly has a tendency of dissolving spontaneously after short time.

The patients have been confined to bed for 1—2 weeks after the operation.

The operated patients have been submitted to a continuous control and so far no signs of relapse have appeared. Those, that showed signs of heart-failure before the operation, have been

fully compensated after it. Where before the operation a certain retarded physical development was established, this development made great progress post-operatively and the patients are now normally developed for their age. The patient, presenting ulcerations of the legs, has not shown any signs of heart-failure whatsoever after the operation and the ulcerations have not reappeared. However, it is still too early to render a definite judgment of the patients, but they will continue to be examined at regular intervals and the results thereof will be presented in a later publication.

### Addendum.

After having written this article 10 more cases of uncomplicated patent ductus arteriosus have been operated upon. In 4 cases the ductus was divided and in 6 cases it was ligated. All are well. 3 more cases were complicated with sepsis, originating from the ductus. In the first case the ductus was divided and the patient as it seemed fully recovered. After some months however recurrence and death in connection to a new attempted operation. The other 2 cases are operated only a few weeks ago and have so far had a normal convalescence.

### Summary.

The work is based on a material of 20 patients between the ages of 2 and 29, that have been operated upon for patent ductus arteriosus.

Earlier investigations have given elucidating information as to the anatomy and functional pathology of patent ductus arteriosus. It is true that the importance of the continuous murmur for the diagnosis has been held forth before, but according to our opinion, too much importance has been attached to other symptoms such as roentgenographic changes, blood-pressure readings and Gerhard's dullness. The examination of the present material still more emphasizes this importance of the continuous murmur for the diagnosis. This murmur is distinguished from the systolic as well as the diastolic one by its characteristic position in the pulse-period and by its force, especially in the low ranges of frequency. Phonocardiographic registration establishes the na-

ture of the murmur objectively. The murmur also exists in other conditions (among others in cases of persisting tricus communis, which for the first time has been shown here), but there is no other disease of the heart, that displays a continuous murmur with its maximal intensity over the pulmonary orifice.

The remaining clinical symptoms are inconstant. High pulse pressure occurs in about half of the cases. A normal electrocardiogram is typical of the disease and suggests an extracardial localisation of the anomaly. The changes met with are slight axis deviation both to the left and right and slight signs of secondary myocardiac damage. The roentgenographic examination of the heart and lungs may give normal roentgenograms, but enlargement of the heart to the left, protruding pulmonary arch and pulmonary congestion is observed in most cases. Sometimes one of them isolated, sometimes all together. These roentgenographic changes, however, are not typical of patent ductus arteriosus, but are also present in other congenital anomalies of the heart.

Supported by earlier investigations about the prognosis of none-operated cases of patent ductus arteriosus, we vindicate the opinion, that all patients with uncomplicated patent ductus arteriosus should be operated upon. Thereby, consideration also has been taken to the fact, that patients with this heart affection are greatly handicapped in their possibilities of making an ordinary social career.

After a short description of GROSS' technique, a detailed description has been given of the technique, that CRAFOORD has employed in the operations of our patients. In 12 cases the ductus was dealt with by twofold ligation and thereafter injection of a 50 % glucose solution between the ligatures, in 8 cases the ductus was divided and the stumps were closed by blood-vessel sutures. One patient has died shortly after the procedure, probably on account of heart arrest, due to reflex caused by the rapid pressure change in the tracheobronchial system by suction with a relatively wide catheter through a tracheal tube of small calibre after the operation was completed.

No relapses have occurred yet. Those patients, that before the operation showed symptoms of decompensation, have been fully compensated afterwards, and those, that before the operation showed retarded physical development, have postoperatively improved their general condition of health considerably.

### Zusammenfassung.

Die Arbeit fusst auf einem Material von 20 Patienten im Alter von 2—29 Jahren, die wegen eines offenstehenden Ductus Botalli operiert wurden.

Frühere Untersuchungen haben klarlegende Auskünfte über die Anatomie und Pathophysiologie des offenstehenden Ductus Botalli gegeben. Inbezug auf die Diagnostik hat man früher zwar die Bedeutung des kontinuierlichen Geräusches hervorgehoben. Unserer Ansicht nach hat man jedoch den übrigen Symptomen, wie den Röntgenveränderungen, dem Verhalten des Blutdruckes und der Gerhardschen Dämpfung, allzu grosse Bedeutung beigemessen. Die Untersuchung des hier vorliegenden Materials hebt die Bedeutung des kontinuierlichen Geräusches für die Diagnose noch stärker hervor. Dieses Geräusch unterscheidet sich sowohl von dem systolischen als auch von dem diastolischen durch seine charakteristische Lage in der Pulsperiode sowie durch seine sehr bedeutende Stärke, besonders in den Gebieten mit niedrigerer Frequenz. Phonokardiographische Registrierung lässt die Natur des Geräusches objektiv festschlagen. Das Geräusch kommt auch bei anderen Zuständen vor (u. a. in Fällen von persistendem Truncus communis, was hier erstmalig nachgewiesen wurde), doch gibt es keinen anderen Herzfehler mit kontinuierlichem Geräusch, dessen Punctum maximum über dem Pulmonalisostium gelegen ist.

Die übrigen klinischen Symptome sind inkonstant. Grosse Blutdrucksamplitude kommt in etwa der Hälfte der Fälle vor. Ein normales Elektrokardiogramm ist für die Krankheit typisch und deutet auf die extrakardiale Lage der Missbildung hin. Die zu findenden Veränderungen bestehen in leichtem sowohl Rechts- als auch Linksüberwiegen sowie leichten Anzeichen einer sekundären Myokardschädigung. Die Röntgenuntersuchung von Herz und Lungen kann normale Bilder ergeben, doch findet man bei der Mehrzahl der Kranken Linksvergrösserung des Herzens, vorspringenden Pulmonalisbogen und vermehrte Gefässzeichnung in den Lungenfeldern. Diese röntgenologischen Veränderungen sind jedoch nicht typisch für den offenstehenden Ductus Botalli, sondern kommen auch in anderen Fällen von kongenitalen Herzfehlern vor.

An Hand fruherer Untersuchungen uber die Prognose nicht operierter Falle von offenstehendem Ductus Botalli, wollen wir die Ansicht verfechten, dass alle Patienten mit offenstehendem Ductus Botalli ohne Komplikationen operiert werden sollten. Hierbei hat auch der Umstand Beachtung gefunden, dass fur Menschen mit diesem Herzfehler die Moglichkeiten in bezug auf ihre soziale Karriere sehr stark beschnitten sind.

Nach einer kurzen Beschreibung der GROSS'schen Technik, wird eingehend uber die von CRAFOORD bei den Operationen an unseren Kranken verwendete Technik berichtet. Bei 12 der Kranken wurde der Ductus durch doppelte Ligatur und Einspitzung von 50 %-iger Glukose zwischen die Ligaturen versorgt, bei 8 der Kranken wurde der Ductus durchtrennt und die Stumpfe mit Gefasssuturen vernahet. Ein Patient ist im Anschluss an den Eingriff gestorben, wahrscheinlich durch einen auf reflektorischem Wege erzeugten Herzstillstand infolge der raschen Druckveranderung, die im Tracheo-Bronchialsystem nach Abschluss der Operation beim Saugen mit einem groben Katheter durch einen verhaltnismassig feinkalibrigen Trachealtubus entstand.

Es sind bisher keine Ruckfalle aufgetreten. Diejenigen Kranken, die vor der Operation Dekompensationssymptome aufwiesen, waren nachher vollig kompensiert, und die, die vor der Operation physische Unterentwicklung aufwiesen, zeigten postoperativ bedeutende Besserung ihres Kraftezustandes.

### Résumé.

Le travail est basé sur un matériel comprenant 20 malades de l'âge de 2—29, qui furent opérés pour persistance du conduit

Des recherches antérieures ont élucidé l'anatomie et la physiologie pathologique du conduit de Botall. En ce qui concerne le diagnostic on a, à vrai dire, souligné autrefois la signification du souffle continu. Mais d'après mon opinion on a cependant attaché trop d'importance aux autres symptômes, tels que modifications radiologiques, caractères de la pression sanguine et matité de Gerhard. L'examen du matériel présenté fait ressortir une fois de plus le rôle diagnostique du souffle continu. Il se distingue du souffle systolique aussi bien que du diastolique par son siège caractéristique dans le cycle de la pulsation, ainsi que par sa très

grande force, surtout lorsque la pulsation est basse. L'enregistrement phonocardiographique établit d'une façon objective la nature du souffle. Pareil souffle existe aussi dans d'autres états (par ex. en cas de persistance du tronc commun, ce qui a été montré ici pour la première fois), mais il n'y a aucun autre vice cardiaque avec souffle continu dont le point maximum soit situé au-dessus de l'orifice de la pulmonaire.

Les autres symptômes cliniques sont inconstants. Une forte amplitude de la pression artérielle existe dans à peu près la moitié des cas. Un électrocardiogramme normal est typique pour l'affection et indique que la malformation est de siège extracardiaque. Les modifications qu'on rencontre consistent en une hypertrophie modérée tant droite que gauche, ainsi qu'en de légers signes de lésion secondaire du myocarde. L'examen radiologique du cœur et des poumons peut donner des images normales, mais l'agrandissement du cœur vers la gauche, un arc pulmonaire proéminent et une accentuation du dessin vasculaire des champs pulmonaires se voient chez la plupart des malades. Par ailleurs ces modifications radiologiques ne sont pas caractéristiques de la persistance du conduit de Botal et on les trouve même dans d'autres cas de vices congénitaux.

Nous appuyant sur des recherches antérieures touchant le pronostic des cas non opérés de conduit de Botal persistant, nous voulons défendre la thèse que tous les sujets atteints de cette affection sans autres complications doivent être soumis à l'intervention. Ce disant nous avons aussi tenu compte du fait que les malades atteints de ce vice cardiaque voient les possibilités de leur carrière sociale réduites à un haut degré.

Après une courte description de la technique de Gross, celle que CRAIÖÖRD a employée pour opérer nos malades est rapportée en détail. Chez 12 d'entre eux le conduit fut lié en deux endroits et du glucose à 50 % injecté entre les ligatures, chez les 8 autres le conduit fut sectionné et ses deux moignons furent refermés par des sutures vasculaires. Un patient mourut à la suite de l'intervention, vraisemblablement d'un arrêt du cœur survenu par voie réflexe à cause du changement brusque de pression dans le système trachéo-bronchique provoqué par l'aspiration faite au moyen d'une sonde relativement grosse introduite au travers d'un tube trachéal de petit calibre, après la fin de l'opération.

Aucune récidive n'est survenue jusqu'ici. Les malades qui avant l'opération avaient eu des symptômes de décompensation

se sont trouvés ensuite dans un état de compensation complète et ceux qui auparavant avaient présenté un développement physique inférieur à la normale ont vu après l'intervention leur état général s'améliorer considérablement

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# Über die Appendicitisfrequenz unter schwedischen Krankenschwestern.

Von

GUSTAF PETREN

(Vortrag vor dem Schwed. Chirurgenverein am 27. Nov. 1943)

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In Vorträgen<sup>1</sup> auf früheren Jahresversammlungen des Chirurgenvereins habe ich die Ergebnisse von Untersuchungen über die Appendicitisfrequenz teils unter der Bevölkerung der Städte Malmö, Helsingborg und Lund während der Fünfjahresperiode 1935—39, teils unter 1 425 Ärzten und Medizinstudierenden, und zwar den überlebenden von denen, die in den letzten 50 Jahren ihren chirurgischen Kursus an der Lunder Chirurgischen Klinik absolviert haben, vorgelegt. Als Hintergrund zu meinem heutigen Vortrag seien die wesentlichen Ergebnisse dieser beiden früheren Untersuchungen zunächst ganz kurz rekapituliert. Die Untersuchung über die Appendicitisfrequenz in den drei genannten schwedischen Städten zeigte, dass etwa 0,23—0,24 % der dort wohnhaften Bevölkerung jährlich an akuter Appendicitis erkranken, und zwar die männlichen Individuen in etwas höherem Ausmass mit etwa 0,26 %, also 1 von 400, als die weiblichen mit etwa 0,21 %, somit 1 von 500. Was die Häufung in den einzelnen Altersklassen betrifft, ergab die Untersuchung in guter Übereinstimmung mit dem seit alters wohlbekannten Sachverhalt, dass die Appendicitismorbidität in den Altersklassen 15 bis 25—30 Jahre am grössten ist und nach dem dreissigsten Lebensjahr mit jeder Fünfjahresperiode prozentual abnimmt. Als Erklärung für die

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<sup>1</sup> G. PETRÉN, Om den arliga frekvensen akuta appendicitfall i Malmö, Lund, Helsingborg och Upsala. Svensk Läkaretidning 1941 und in Der Chirurg, Bd. 13, 1941. — G. PETRÉN, Bidrag till frågan om appendicitfrekvensen i den svenska läkarchären. Svensk Läkaretidning 1943 und in Der Chirurg, Bd. 15, 1943.

etwas niedrigere Appendicitisfrequenz unter der weiblichen Bevölkerung im Vergleich zur männlichen fand ich bei eingehenderer Bearbeitung des Materials das bis dahin nicht sehr beachtete Verhältnis, dass die Morbidität, die bei den Fünfzehn- bis Fünf- undzwanzigjährigen in beiden Geschlechtern etwa gleich gross ist, in den Altersgruppen 30—40 Jahre und noch starker ausgesprochen in den Altersgruppen 40—50 Jahre bei den Frauen eindeutig niedriger ist als bei den Männern. Nach dieser Untersuchung beruht also die geringere Appendicitisfrequenz in der weiblichen Bevölkerung auf einer niedrigeren Appendicitismorbidität unter den Frauen in den Dreissigern und noch mehr in den Vierzigern, verglichen mit den Männern derselben Altersklassen. In Würdigung dieser Ergebnisse sprach ich folgenden allgemeinen Gesichtspunkt aus: Der Mensch läuft offenbar die relativ grösste Gefahr, an Appendicitis zu erkranken, wenn er in seinen besten, lebenskräftigsten Jahren ist, im Alter von 15—30 Jahren, wie die zahlenmassigen Ergebnisse aller Untersuchungen über die Appendicitisfrequenz zeigen, mag dies nun auf ein örtliches Moment in der Appendix oder auf einen ganz anderen, mehr allgemeinen Faktor zurückzuführen sein. Mit 40 bis 50 Jahren ist die Mehrzahl der Frauen unstrittig in höherem Grade im Beginn des Alterns, als die Mehrzahl der Männer, und *damit* verringert sich wahrscheinlich für die Frauen schon jetzt, ebenso wie in noch höherem Grade nach Erreichung des 50 und 60 Lebensjahres für beide Geschlechter, das Risiko, an Appendicitis zu erkranken.

Ausgehend von den bei dieser Untersuchung gefundenen Zahlen für die drei schwedischen Städte, berechnete dann der Statistiker der Universität Lund, Prof. C. E. QUENSEL, ein wie grosser Teil der männlichen und weiblichen Bevölkerung dieser Städte an bestimmten Altersgrenzen, mit 10 Jahren, 20 Jahren usw. bis zu 70 Jahren Appendicitis gehabt haben wird. Zu diesen Prozentzahlen als Vergleichszahlen in einer Tabelle kommen wir noch zurück. Hier seien nur die Hauptergebnisse der Quenselschen Berechnung angeführt von der heute lebenden Bevölkerung dieser drei Städte durften 13,8 %, d. h. jeder siebente Mensch in seinem Leben irgendwann an akuter Appendicitis erkranken.

Die zweite Untersuchung, die Appendicitisfrequenz unter den 1425 ehemaligen und jetzigen Lunder Medizinstudierenden betreffend, lieferte das Hauptergebnis, dass nicht weniger als 25,5 % von ihnen, also jeder vierte, bisher (d. h. bis 1942) akute Appendicitis gehabt hatte, von den 125 Medizinerinnen der Zusammen-

stellung hatten in gutem Einklang mit dem Ergebnis aus der Untersuchung betreffs der 3 Städte geringere Frequenz in der weiblichen als in der männlichen Bevölkerung, eine etwas kleinere Anzahl, nämlich 21,6 %, Appendicitis gehabt. Unter diesen 1425 Ärzten und Medizinstudierenden war also, obgleich ein grosser Teil von ihnen zur Zeit der Untersuchung noch jugendlich oder in den besten mittleren Jahren war, die Appendicitisfrequenz bedeutend höher als die von QUENSEL für die jetzt lebende Bevölkerung der drei schwedischen Städte berechnete. In meinem letzten Vortrag hielt ich mich auch für berechtigt, selbst bei Beachtung<sup>1</sup> dessen, dass die für die 3 Städte gefundenen Zahlen ein wenig zu niedrig sein konnten, folgenden Schluss zu ziehen mit einer an Gewissheit grenzenden Wahrscheinlichkeit: zeigen diese beiden Untersuchungen, dass die Appendicitisfrequenz in Schweden wenigstens in gewissen verschiedenen Bevölkerungsgruppen, Berufen oder sozialen Schichten verschieden ist.

Angesichts dieser beiden Untersuchungen erschien es mir von Interesse, eine Appendicitisfrequenzuntersuchung, genau nach den gleichen Prinzipien wie betreffs der 1425 Mediziner, an einer grosseren Anzahl von Angehörigen der schwedischen Krankenschwesternschaft durchzuführen.

Diese Untersuchung umfasst die Schwesternschaft des *Södra Sveriges Sjukhotersbädd* (Südswedischen Schwesternheims) in Lund seit Begründung der ihm angeschlossenen Ausbildungsanstalt für Krankenschwestern — der erste Lehrgang legte 1905 das Examen ab — und die augenblicklichen *Lehrschwestern* (bis einschliessend im Frühjahr 1943 aufgenommenen Zöglinge). Die Gesamtzahl der Schwestern, die in den letzten 40 Jahren durch das »Heim« ausgebildet worden sind oder jetzt in der Ausbildung stehen, beträgt 1772. Von diesen sind inzwischen 45 verstorben — entweder bisher keine einzige der Schwestern, die aus den Kursen nach 1935 hervorgegangen sind. Die Gruppe der Verstorbenen bleibt bei der Untersuchung unberücksichtigt, da es selbstverständlich bei einer ganzen Reihe von ihnen — einige starben bereits vor 20 bis 30 Jahren — nicht mehr möglich ist, zuverlässige Angaben darüber zu erhalten, ob sie zu Lebzeiten Appendicitis gehabt haben. Abzüglich der 45 verstorbenen bleiben also 1727 Schwestern, die bei Abschluss der Untersuchung im Sommer 1943 am Leben waren. Es ist nun gelungen, in erster

<sup>1</sup> Siehe hierzu den früheren Aufsatz

Linie dank dem Schwesternregister des »Heimes« und bereitwilliger Hilfe von seiten des »Heim«-Buros, doch auch dank wohlwollender Mitwirkung früherer Lehrgangskolleginnen und von Angehörigen, von nicht weniger als 1724 Bescheid zu bekommen — am schwierigsten waren einige aufzufinden, die nun schon vor langer Zeit durch Heirat aus der Schwesternschaft ausgeschieden sind, sowie mehrere im Ausland wohnhafte Nur von dreien — weniger als 0 2 % des ganzen Materials — haben also keine Angaben erhalten werden können Die erste Schwierigkeit bei einer Untersuchung wie der vorliegenden die betreffenden Personen aufzuspüren und die einschlägigen Auskünfte zu erhalten, hat also gut gemeistert werden können

Die zweite Schwierigkeit betrifft die Beurteilung der eingelaufenen Angaben auf den ausgefüllten Fragebogen über durchgemachte Appendicitis bei einem Teil der Fälle, namentlich solchen Fällen, die nicht operiert oder im schmerzfreien Intervall oder als chronische Appendicitisfälle operiert worden sind oder die bei der Operation im akuten Stadium nur leichtere, diskutable Appendixveränderungen aufgewiesen hatten In allen Fällen, die in den Krankenhäusern in Lund, Malmö, Helsingborg und Ängelholm operiert worden sind, habe ich persönlich die Operationsberichte und etwaigen Krankengeschichten durchgesehen In den übrigen den Angaben nach nicht eindeutigen Fällen habe ich ergänzende (bisweilen berichtigende) Angaben von den Krankenhäusern erhalten, in denen die betreffenden Schwestern wegen der Appendicitis behandelt bzw operiert worden waren Allen 40 Krankenhausärzten, die mir mit grossem Entgegenkommen Auszüge aus Tagebüchern und Operationsberichten zugestellt haben, wodurch eine sichere, oft völlig sichere Beurteilung der fraglichen Fälle ermöglicht wurde, sage ich an dieser Stelle herzlich Dank In einigen Fällen blieb es indessen auch unter Auswertung aller zur Verfügung stehenden Angaben schwer zu entscheiden, ob der betreffende Fall als Appendicitis zu verbuchen sei oder nicht Bei diesen Entscheidungen habe ich mich bemüht, ziemlich strenge Gesichtspunkte anzulegen Ich habe alle diejenigen ausgeschlossen, die mir nicht als sichere oder so gut wie sichere Appendicitisfälle erschienen, habe also nach Möglichkeit nach denselben Richtlinien gewertet wie in den beiden früheren Untersuchungen Auch betreffs des vorliegenden Materials glaube ich also sagen zu können, »dass nur ausserst wenige Fälle in das Material aufgenommen sind, bei denen es sich nicht wirklich um akute Appendi-

citis gehandelt hat, eher dürfte dieser oder jener Fall ausgeschlossen worden sein, der unsicher schien, bei dem aber vielleicht doch eine Appendicitis vorgelegen hat»

Das Hauptergebnis der Untersuchung wird in Tabelle 1 vorgelegt

Tabelle 1

*Anzahl der akuten Appendicitis-fälle unter 1724 ehemaligen und jetzigen Krankenschwestern und Lehrschwestern des Sodra Steniges Sjukvårskolehem (Sudschwed Krankenschwesternheims)*

Alter 1943	Durchschnitts alter der Gruppe	Gesamtzahl der Erfassten	Anzahl der an Appendicitis Erkrankten	Appendicitis %
65—69 Jahre	67—68 Jahre	8	1	12 5
55—64 „	60 „	81	15	18 „
45—54 „	50 „	186	43	23 1
35—44 „	40 „	445	95	21 3
25—34 „	30 „	751	125	16 6
21—24 „	22—23 „	253	32	12 6
	Zusammen	1 724	311	18 0 %

Wie wir aus den Gesamtzahlen der Tabelle ersehen, sind die Angaben über durchgemachte akute Appendicitis von 311 der 1724 befragten Krankenschwestern und Lehrschwestern anerkannt worden. Unter diesen 311 befinden sich 2 nicht operierte Fälle sowie 8, die nicht im akuten Stadium operiert sind, die übrigen 301 sind als akute Appendicitiden operiert worden. Von Interesse ist ferner im Zusammenhang mit den Ziffern dieser Tabelle, dass ausserdem nicht weniger als 114 auf die Diagnose, evtl. Wahrscheinlichkeitsdiagnose »Appendicitis« operiert worden sind, aber nach kritischer Prüfung aller vorliegenden Angaben nach den von mir befolgten Richtlinien für die Beurteilung nicht als sichere akute oder früher akute Appendicitis anerkannt werden konnten. Von diesen 114 Fällen waren 23 im »freien Intervall« oder als chronische oder subchronische Fälle, die übrigen 91 als »akute Bauchfälle« operiert worden. In vielen von diesen Fällen erhob die Operation den Befund einer eindeutig unschuldigen Appendix, bei einem grossen Teil der Fälle fand man mehr oder weniger unbedeutende, unsichere, diskutabile Appendixveränderungen. Von allen 123 unter den 1724 Untersuchten als Appendicitis operierten Fällen sind also 114, d. h. 27 %, nicht als sichere Appendicitiden anerkannt, sondern als solche ausgeschlossen worden.

Die entsprechende Prozentzahl bei der fruheren Untersuchung an Arzten und Medizinstudierenden, von denen 90 % Manner waren, war weit niedriger, namlich 10 %. Dass Frauen in weit grosserem Umfang als Manner wegen leichter oder unsicherer Appendicitis operiert werden, ist seit langem bekannt<sup>1</sup>. Das hangt ganz natuerlich damit zusammen, dass verschiedene gynakologische Krankheiten und auch das bei Frauen weit haefigere Gallensteinleiden nicht selten, besonders im fruhen Stadium, ein differentialdiagnostisch schwer deutbares, appendicitisahnliches Krankheitsbild ergeben.

Die Summenzahlen der Tabelle geben das *Hauptresultat der Untersuchung*: 311 der 1724 Krankenschwestern und Lehrschwestern, also 18 %, haben bis zum Zeitpunkt der Untersuchung akute Appendicitis gehabt. Die fruhere, nach genau denselben Prinzipien durchgefuehrte Untersuchung der 1425 Mediziner hatte, wie erwahnt, ergeben, dass 25.5 % von ihnen akute Appendicitis gehabt hatten, von den Medizinerinnen jedoch nicht mehr als 21.6 %. Die hier fur die Krankenschwestern gefundene Morbiditatsziffer liegt also ein wenig, nicht viel niedriger als die fur Arztinnen und Medizinstudentinnen ermittelte. Im grossen ganzen durften diese beiden Materialzusammenstellungen gut vergleichbar sein. Beachtet werden muss indessen, dass die ganze Gruppe der Krankenschwestern und Lehrschwestern (davon 1004 auf 1724, also 58 %, unter 35 Jahre alt) im Durchschnitt etwas junger ist als die Medizinerinnengruppe (49 von 125, also nur 39 %, unter 35 Jahre alt). Dementsprechend muss die Krankenschwesternschaft eine geringere Appendicitismorbiditat haben als die Arztinnen, und die fur beide Gruppen gefundenen Frequenzzahlen sind folglich als gut ubereinstimmend zu bezeichnen.

Was die Frequenz in den einzelnen Altersklassen angeht, zeigt die Tabelle, wie zu erwarten war, mit zunehmendem Alter eine steigende Haefigkeitsziffer von 12.6 % der 22—23jaehrigen bis auf 23.1 % der 50jaehrigen. Bei den Sechzigjaehrigen ist dagegen die Prozentzahl etwas niedriger, namlich 18.5 % (auch die Medizineruntersuchung ergab fur die Sechzigjaehrigen eine niedrigere Prozentzahl als fur die Funfzigjaehrigen, siehe Tab. 2). Die fur die 67—68jaehrigen gefundene Prozentzahl (12.5 %) ist ohne Interesse, da es sich hier nur um wenige Personen handelt (8 Krankenschwestern).

<sup>1</sup> Siehe z. B. E. PERMAN: Über die Diagnose der Appendicitis beim Weibe. Acta chir. scand., Bd. 63, 1928.

Tabelle 2

*Prozentuale Appendicitisfrequenz in verschiedenen Altersklassen bei 1 425 Medizinern, 1 724 Krankenschwestern und der Bevölkerung dreier schweizer Städte (der letzte Wert nach Quensel)*

Durchschnitts- alter der Unter- suchten	Mediziner- Untersuchung			Appendicitis % unter der männl. Bevölke- rung der 3 Städte nach Quensel	Krankenschwestern- Untersuchung			Appendicitis % unter der weibl. Bevölke- rung der 3 Städte nach Quensel
	Anzahl der Unter- such- ten	Anzahl der an ak. App- Erkrank- ten	Ap- pen- dicitis %		Anzahl der Unter- such- ten	Anzahl der an ak. App- Erkrank- ten	Ap- pen- dicitis %	
70 Jahre <sup>1</sup>	72	19	26 1 %	17 0 %	18	1	12 5 %	13 , %
60 „	118	32	27 1 %	15 9 %	81	15	18 5 %	12 1 %
50 „	362	112	30 9 %	11 2 %	186	43	23 1 %	11 2 %
40 „	418	107	25 6 %	12 1 %	115	95	21 3 %	9 9 %
30 „	455	94	20 7 %	9 5 %	751	125	16 6 %	8 , %
22-23 „					253	32	12 6 %	6 5 %

In Tabelle 2 sind vergleichshalber die Prozentzahlen der Appendicitisfrequenz für die einzelnen Altersgruppen zusammengestellt, wie sie sich aus allen drei Untersuchungen ergeben haben.

Da die Untersuchung für die ganze Krankenschwesterngruppe eine niedrigere Appendicitisfrequenzzahl ergeben hat als die Mediziner-Untersuchung, ist es klar, dass die prozentuale Häufung, wie die Tabelle zeigt, auch in den einzelnen Altersgruppen der Krankenschwesternschaft geringer sein muss. Im übrigen stimmen die beiden Untersuchungen insofern gut überein, als die gefundenen Prozentzahlen sämtlicher 4 Altersklassen zwischen 30 und 60 Jahren bei den Krankenschwestern etwa im selben Verhältnis unter den entsprechenden Werten der Mediziner-Untersuchung liegen. Von grösserem Interesse ist es jedoch, die gefundene Appendicitisfrequenz in den einzelnen Altersgruppen der Mediziner und der Krankenschwestern mit den von Prof. QUENSIL errechneten Zahlen zu vergleichen, die angeben, in wie grosser Teil der gesamten männlichen bzw. weiblichen Bevölkerung der drei schweizer Städte im gleichen Alter Appendicitis gehabt haben wird. Wie aus der Tabelle hervorgeht, herrscht hier das bemerkenswerte Verhältnis, dass in den meisten Altersklassen der Ärzte wie der Schwestern (bei den Ärzten im Alter von 30—60 Jahren, bei den Krankenschwestern von 22—50 Jahren) die Appendicitisfrequenz in über-

<sup>1</sup> Das Durchschnittsalter der 8 Krankenschwestern ist nicht ganz 70 Jahre, sondern 67—68 Jahre.

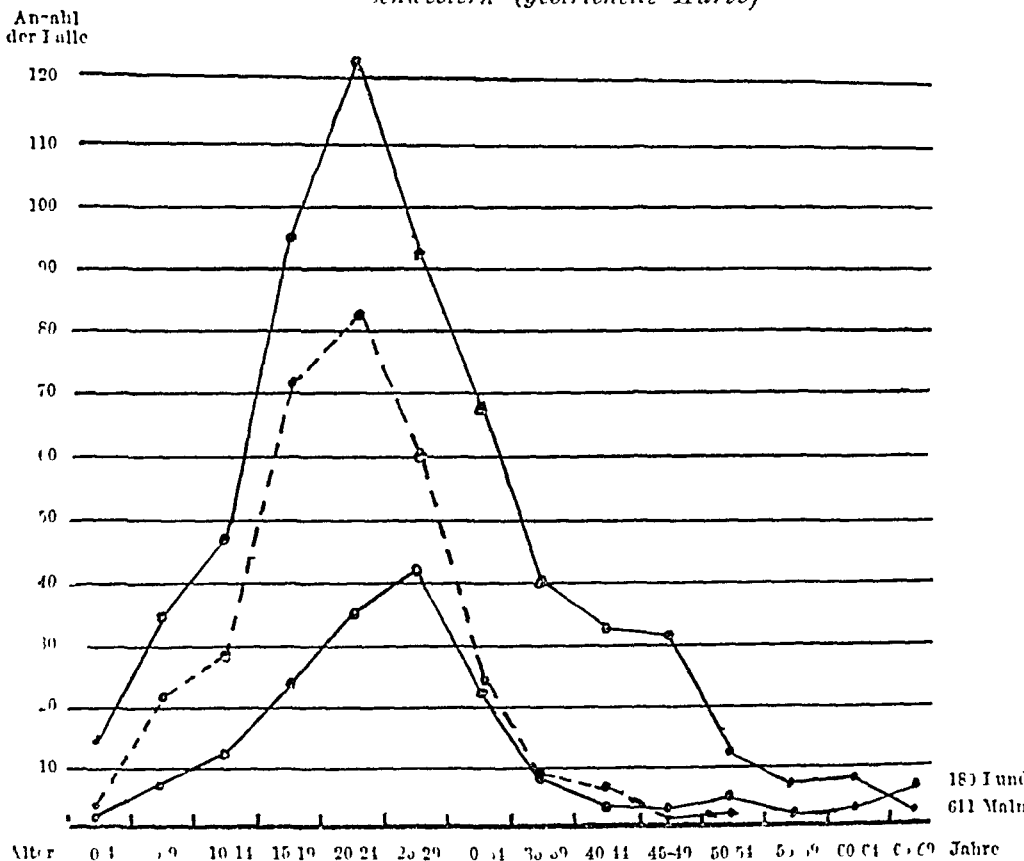
raschend ubereinstimmender Weise *etwa* doppelt so hoch ist wie in den entsprechenden Altersgruppen der mannlichen bzw weiblichen Bevolkerung der drei Stadte Wenn man nun davon auszugehen wagt — zweifellos ist es in gewissem Grade hypothetisch —, dass die fur die drei schonischen Stadte berechneten Appendicitiszahlen etwa Normalzahlen darstellen, die fur die mannliche und weibliche Bevolkerung schwedischer Stadte insgesamt gelten, so lassen diese Untersuchungen folgendes erkennen *Die Appendicitisfrequenz ist in etwa gleichem Ausmass bei schwedischen Arzten wie schwedischen Krankenschwestern im Vergleich zur gesamten mannlichen bzw, weiblichen Stadtbevolkerung Schwedens stark gesteigert, und zwar ist sie fur die beiden Berufsgruppen etwa doppelt so hoch wie in der Gesamtbevolkerung*

Sucht man nach einer Erklarung fur diese relativ hohe Appendicitisfrequenz in der Arzte- und Krankenschwesternschaft, so drangt sich die Frage auf kann es nicht eine Rolle spielen, dass der Arzt und die Krankenschwester, wenn akute Baucherscheinungen auftraten, sich mit grosserer Sachkenntnis beobachten (bzw, was die Lehrschwestern angeht, sachkundiger beobachtet werden), als es bei der Bevolkerung im allgemeinen der Fall ist, und dass dementsprechend haufiger die richtige Diagnose bei Appendicitis gestellt wird? Eine gewisse Rolle mag dieser Umstand vielleicht spielen, doch ist es m E ausgeschlossen, dass diese Rolle irgendwie von grosserer Bedeutung ist fur die hohe Frequenz unter Arzten und Krankenschwestern im Vergleich zur Frequenz unter der Gesamtbevolkerung der Stadte Lund, Malmo und Halsingborg Jeder einzelne in diesen Stadten kann namlich jederzeit arztliche Hilfe leicht erhalten, und die Arzte empfehlen seit langem bei jeder eindeutigen Appendicitis und sicherlich weitgehend auch Patienten mit leichteren oder unklarer akuten Baucherscheinungen Krankenhauspflege bzw -observation und weisen diese Falle in die Krankenhauser ein In der beigegebenen graphischen Darstellung ist ferner eine Kurve eingezeichnet, die ausweist, in welchem Alter die 311 Kranken- und Lehrschwestern wegen Appendicitis operiert worden sind, neben zwei Kurven aus einer alteren Untersuchung,<sup>1</sup> die ausweisen in welchem Alter 611 Appendicitisfalle aus der Malmoer Bevolkerung und 180 Falle aus der Lunder Bevolkerung (beide Zusammenstellungen aus den Jahren 1907—10) operiert wurden Wie man sieht, sehen diese

<sup>1</sup> G PETRÉN, Om den akuta appendicitens frekvens i staderna Lund och Malmo aren 1907—1910 Allm Sv Lakares 1911



Graphische Darstellung des Erkrankungsalters bei 611 Appendicitisfällen unter der Malmoer Bevölkerung, 180 Appendicitisfällen unter der Lunder Bevölkerung, 311 an Appendicitis erkrankten Krankenschwestern (gestrichelte Kurve)



Kurven emander ziemlich ähnlich, und die Krankenschwesternkurve zeigt keine starker von den beiden »Bevölkerungs«-Kurven abweichende Steigerung der Appendicitisfrequenz in der Altersgruppe 20—21 Jahre und folgende — die meisten Zöglinge des Heims beginnen mit ihrer Krankenpflegeausbildung im Alter von 21 bis 25 Jahren. Die Krankenschwestern-Kurve gibt, auch unter Berücksichtigung dessen, dass die Zusammenstellungen statistisch nicht in jeder Beziehung vergleichbar sind, keinen Anhalt dafür, dass die Appendicitisfrequenz unter diesen 1724 Frauen im Zusammenhang mit ihrem Eintritt in die Krankenpflege nennenswert gestiegen wäre.

ME wird also auch durch diese Untersuchung entschieden die in meinem letzten Vortrag ausgesprochene Ansicht gestützt,

dass mit an Gewissheit grenzender Wahrscheinlichkeit die Appendicitisfrequenz in Schweden wenigstens unter einigen verschiedenen Bevölkerungsgruppen, Berufen und sozialen Schichten verschieden ist

Einige kurze Schlussbemerkungen! Man kann sich fragen Sind reine Frequenzuntersuchungen von der Art der vorliegenden und die daraus gewonnenen zahlenmassigen Ergebnisse der Muhe wert, die sie kosten? Darauf mochte ich folgendes antworten Solche Untersuchungen konnen von einem *weiteren* Gesichtspunkt aus ein bedeutend grosseres Interesse haben, als sie mit ihren direkten Angaben uber die Frequenz an und fur sich besitzen Unsere Einsicht betreffs der verschiedenen ursachlichen Faktoren bei der akuten Appendicitis ist immer noch hochst mangelhaft Manche Forscher haben gesagt Die Grundfrage der Appendicitis ist ein anthropologisches Problem, andere »Die Appendicitis ist eine durch die europaische Kultur begunstigte Erkrankung«, wieder andere »Die Frage der Appendicitis ist ein Problem der Ernahrungsweise«, beispielsweise in bestimmterer Form »Uebermassiger Fleischgenuss disponiert zur Appendicitis«, einzelne Autoren verfechten den Standpunkt, die Appendicitis sei eine weit haufigere Krankheit unter der Stadtbevölkerung als auf dem Lande, u a m Wenn eine grossere Anzahl von Frequenzuntersuchungen, auf der Basis genügend grosser Materialgruppen aus verschiedenen Landern und fur verschiedene Bevölkerungsgruppen mit der notigen Grundlichkeit und Zuverlässigkeit ausgeführt, vorgelegt werden — soweit ich die Literatur kenne, sind einstweilen wirklich exakte Angaben auf diesem Gebiet selten — so wird wahrscheinlich eine kritische Gegenuberstellung und Vergleichung der Ergebnisse von *ihm* Gesichtspunkt aus in wertvoller Weise die etwaige Bedeutung solcher umstrittenen Kausalfaktoren, wie Konstitution der Bevölkerung, Umweltverhältnisse, soziale Schichtung, Art und Zusammensetzung der Ernährung, fur die im Grunde auch heute noch so dunkle Genese der Appendicitis beleuchten und bestenfalls klarstellen konnen Wie ich es sehe, sind meine Frequenzuntersuchungen ein paar einfache Ziegelsteine zu dem kunftigen Bauwerk, das, wie zu hoffen steht, auf der Basis breiter und vielseitiger betriebener Forschung betreffs der Ätiologie der akuten Appendicitis einst erstehen wird

### Zusammenfassung.

Eine Untersuchung über die Appendicitisfrequenz unter 1721 Krankenschwestern (im Alter von 21—69 Jahren) ergibt, dass 18 % von ihnen Appendicitis gehabt haben. Ein Vergleich zwischen der Appendicitisfrequenz einzelner Altersgruppen unter diesen Krankenschwestern mit der bei einer früheren Untersuchung ermittelten Morbidität in den entsprechenden Altersgruppen der weiblichen Bevölkerung in den drei größten Städten der Provinz Skånen zeigt, dass die Krankenschwestern eine etwa doppelt so hohe Appendicitisfrequenz haben wie die weibliche Bevölkerung der betreffenden Städte.

### Summary.

An investigation on the frequency of appendicitis among 1,724 nurses between the ages of 21 and 69 years revealed that 18 per cent had suffered from this condition. A comparison of the rate of appendicitis in the various age groups of these nurses with that secured for corresponding age groups of the female population in the three principal cities in Skåne in south Sweden, disclosed that the frequency of appendicitis was about twice as high among the nurses as among the latter category of women.

### Résumé

Des recherches portant sur la fréquence de l'appendicite chez 1721 infirmières (âgées de 21 à 69 ans) montrent que 18 % d'entre elles ont été atteintes de cette maladie. La comparaison de la fréquence de l'appendicite dans les diverses classes d'âge de ces gardemalades avec les chiffres qu'une étude antérieure a donnés pour les classes d'âge correspondentes de la population féminine des trois plus grandes villes de Scanie fait voir chez les premières une fréquence de l'appendicite environ double de celle des femmes de ces villes.

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From the Surgical Dep A, Bispebjerg Hospital, Copenhagen  
(Surgeon-in-Chief JENS FOGED, M D)

## Osteosynthesis of the Tibial Condyle.

By

JENS FOGED

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While it appears to be agreed in general that conservative treatment ought to be employed in fractures of the tibial condyle that are free from displacement and not complicated by extensive injury to the ligaments, opinions are divergent as to the treatment when such fractures are associated with considerable displacement

In the more comprehensive works in the Scandinavian literature on this subject (HULTÉN, MIKKELSEN) conservative bloodless treatment is advocated rather categorically, the authors asserting that this gives satisfactory and better functional results than does operative treatment. This view is maintained by many other authors cited by HULTÉN and MIKKELSEN, to whose works the reader may be referred

In contrast hereto, other surgeons consider operative treatment indicated in fracture of the tibial condyles if bloodless reposition of the displacement is impracticable, as these surgeons hold that the establishment of normal anatomical conditions is of fundamental significance to the restoration of the stability and function of the knee-joint

In a preceding paper I have given a survey of methods employed for operative treatment in fractures of the tibial condyles and the results obtained. A review of the literature shows that the operative treatment in most cases gives good results, while in a minority the outcome is unsatisfactory or poor. Here it will be appropriate to mention that most of these authors adopt operative treatment only in the more serious forms of condylar fractures — those with marked displacement. On this background it seems unjustified to dismiss the operative treatment as is done by some surgeons with rather categorically conservative views

In my opinion the treatment of fractures of the tibial condyles should be individualized. In a majority of the cases — namely, those in which there is slight displacement or none at all — the treatment ought to be conservative. On the other hand, with a more pronounced displacement reposition is indicated, and as this may be performed with bloodless technique but seldom, I look upon operative treatment as indicated in such cases.

In fractures of the lower extremities and especially fractures involving the joints, it is the general rule that anatomical reposition is of importance to the prognosis. It would be strange, indeed, if fractures of the tibial condyles made an exception to this rule. This principle has been followed in dealing with such fractures here in the department.

For further elucidation of this question and for comparison of the results of operative and conservative treatment, it will be appropriate to give a brief survey of all cases of fracture of tibia condyles treated in this department in the last six years — namely, from the time I took it over in 1937.

The *material* comprises 41 patients, 19 men and 22 women. The age of these patients is given in Table 1.

Table 1

*Age Distribution of the Patients*

Age (years)	11—19	20—29	30—39	40—49	50—59	60—69	70—77
Operative treatment	1	0	1	3	3	2	2
Conservative "	1	1	4	2	9	8	1

Thus over one-half of the patients belonged to the age-class from 50 to 70 years, the youngest was 14 years, the oldest 77.

The *localization of the fractures* is recorded schematically in Table 2.

Table 2

*Localization of Fractures*

Condyles	Lateral	Medial	Both
Operative treatment	6	2	1
Conservative "	20	9	

The frequency of the injury was the same on the right side as on the left. The fracture was localized more often to the lateral condyle than to the medial — namely, 26 times as against 11. In 1 case the fracture was bicondylar. Not infrequently the fracture was multiple or comminute, in 3 cases there was an additional

fracture of the intercondyloid eminence None of the fractures was open

As to *displacement* Table 3 gives a survey of the roentgenograms concerning this feature

Table 3

*Displacement of the Condylar Fractures*

	No displacement	Increase in width	Depression	Increase in width + depression	Elevation
Operative treatment	0	3		8	1
Conservative	13	2	9	4	1
Total	13	5	9	12	2

Thus there was no displacement of the fracture in 13 cases, while the remaining 28 presented the following forms of displacement lateral displacement in 5 depression of the condyle in 9, combination of lateral displacement and depression in 12, and elevation of the fragment up in the knee-joint in 2

*Hemarthrosis*, more or less pronounced, was present in all the 39 cases of fresh fractures Only 2 patients, who were admitted some time after the accident, showed no sign of hemorrhage into the knee-joint

Several of these patients presented also other *homolateral traumatic injuries*, namely complicated supramalleolar fracture in 1 case, fracture of the proximal part of the crus in 1, fracture of the neck of the tibia in 1, fracture of the crus in 1, fracture of the neck of the fibula in 1, rupture of the Lig collat med gen in 1, metatarsal fracture in 1 In addition, 4 patients had concussion of the brain Practically all these additional injuries were encountered in the group given operative treatment

Furthermore, a good many of the patients were also suffering from diseases which play some rôle as to the indication for a particularly accurate reposition or in judging of the later prognosis, namely uncompensated heart lesion in 1 case, obesity in 5, bilateral or unilateral arthrosis of the knee in 6, sequelae of poliomyelitis (both legs) in 1, senility in 2, arthritis urica of the great toe in 1, mental disease in 1

As to the treatment adopted by this department in condylar fracture of the tibia, in keeping with the aforementioned theoretical principles, the greater part of the present patients — 29 out of 41 — were given conservative treatment We shall return to this group later on

## Operative Treatment

The present work will deal chiefly with the patients who were given operative treatment. This material comprises 12 patients, 3 men and 9 women. All these patients but one were middle-aged or elderly (see Table 1).

In 6 patients the fracture was localized to the lateral condyle, in 2 to the medial, and in 4 it was bicondylar (see Table 2).

*Indications for Operation.* In 11 cases the indication for operative treatment consisted in displacement to the side, with a rather marked increase in width (0.5 cm. or more), in 1 case it consisted in elevation of the condylar fragment up into the knee-joint. In addition 8 patients presented a more or less pronounced depression of the condyle. Further obesity is reckoned as suggestive of operative treatment, as an accurate reposition is considered to be required particularly in such patients in order to counteract the disposition to arthrosis from great strain on the deformed knee-joint.

### *Operative Technique*

Among the various methods for condylar osteosynthesis of the tibia I decided to try out the so-called bolting method. The principal idea of this method is the strong and dosable force that may be employed in the maneuvers of reposition at the same time as the lateral pressure required by means of suitable end-plates is distributed over a fairly large surface of bone.

Independently of various other authors the Danish orthopedic surgeon SVEN KILB (1937) constructed an apparatus after the bolting principle, consisting of a metal bolt with loose end-plates, nut and wrench, all of rust-free steel (Fig. 1).

The bolt is 10 cm. long, with a diameter of 0.3 cm. The two circular end-plates are alike, with a diameter of 2.5 cm., measuring 1 mm. in thickness, being perforated in the center and slightly concave on the surface intended to rest on the bone. With the bolt passing straight through the condylar part of the tibia and provided with an end-plate on the medial and lateral surfaces of the tibial condyles it is practicable in a fracture with increase in width by turning the nut to repose the fracture and keep it aligned.

To me the KILB method appears to offer some conspicuous advantages, and hence I have employed it in all the operated cases but one, in which nail osteosynthesis was employed.

Osteosynthesis ad modum KILÆR may be performed under any form of anesthesia. To me, local or spinal anesthesia appears most recommendable, as the operation — including X-ray control — may last up to three quarters of an hour.

A longitudinal incision, about 4 cm. long, is made on the lateral aspect of the lateral condyle, corresponding to its midpoint, into the periosteum. The soft parts are dissected to a side, making room for the end-plate of the bolt. In the center of the bared condyle a transverse hole is bored with an ordinary osteosynthesis drill, and one end-plate is placed on the condyle.

The bolt is inserted through the hole of the metal plate, into the drill channel. With a hammer the bolt is driven horizontally through the bone and out through the soft parts covering the medial condyle, till the point of the bolt projects under the skin. Here an incision is made, similar to that over the lateral condyle, baring the medial condyle round the bolt, so that the other end-plate may be placed over the bolt on the internal surface of the condyle.

While the square head of the bolt is fixed by means of a pair of pliers, the nut is screwed on the bolt, and by means of the wrench the two end-plates are thus brought towards each other till the diastasis of the bone is abolished. By simultaneous roentgenography or by direct measuring of the free end of the bolt it is possible with a fair degree of accuracy to estimate how much screwing is required. Besides, one practically feels when the reposition is completed, as then the resistance to further compression increases. X-ray control should be employed in every case before the wound is closed — for the sake of eventual correction. Then the projecting end of the bolt is clipped off, and the soft parts are sutured.

In two cases the osteosynthesis was performed under simultaneous arthrotomy of the knee in order to ensure the best possible reconstruction of a comminuted condylar fracture under the guidance of vision and by manual maneuvers.

The one instance of nail osteosynthesis was likewise performed through arthrotomy, as here a fragment projected up into the knee-joint.

*Contraindications* — For such a relatively slight operation as this, contraindications of universal character will naturally be very few. On account of particular local conditions we have considered the operation contraindicated in 4 cases of the present material: in 2 cases on account of phlebitis, in 2 because of the age



of the fracture on admission of the patients (respectively 6 weeks and 2 months)

The *general regimen* adopted for patients given operative treatment is

As a rule manual reposition or extension is tried before osteosynthesis is resorted to, confinement to bed and — if not extension treatment — immobilization bandage for about one week. Besides, in the presence of hemaithion, puncture of the knee-joint with evacuation. If the X-ray control still shows considerable displacement, osteosynthesis is performed as a rule 8—10 days after the fracture then confinement to bed with immobilizing bandage till all pain in the wound has subsided and the temperature is normal.

Now immobilization is discontinued and exercise of the quadriceps is instituted. Usually the patient gets up, sitting, about two weeks after the operation, and two weeks later he commences cautiously to put weight on the limb in perambulator. In another week he goes on to walk about with the support of crutch-canes and later with an ordinary cane. About 8—10 days later the patient usually is able to walk about without any support and to be discharged from the hospital with instruction about further exercises at home or he is transferred to a convalescent resort. Half a year later he is readmitted for removal of the osteosynthesis bolt.

Deviations from this schema are required not infrequently. Sometimes the osteosynthesis has to be postponed on account of complicating affections (*e g* concussion of the brain, simultaneous fracture of the crus).

Occasionally the confinement to bed has to be extended for a considerable length of time and the exercising therapy has to be postponed on account of complications (*e g*, phlebitis, infarction). Once it has been necessary to immobilize the knee for a long period because of a homolateral fracture of the crus at a high level.

At first we removed the bolt about one month after the operation for fear of pressure necrosis of the bone — which subsequently proved unnecessary. Like in other forms of osteosynthesis, therefore we have gone on to leave the fixation material in the bone for about half a year.

For illustration it will be appropriate here to give a brief abstract of one of the case histories

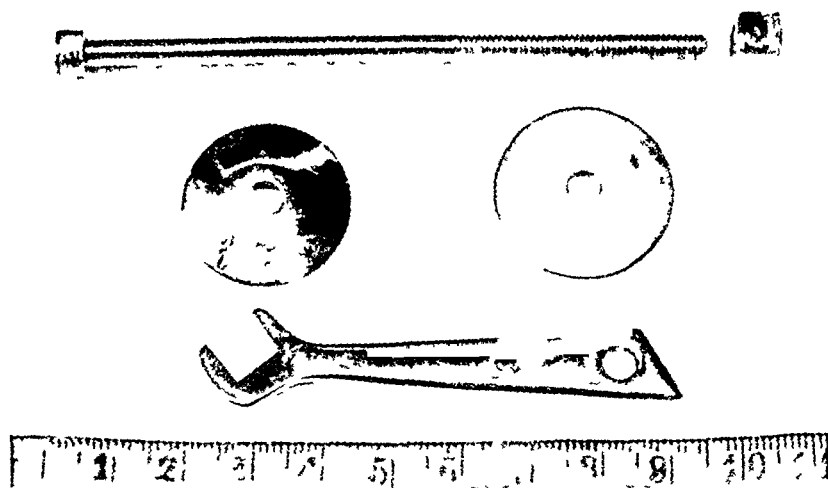


Fig 1 Dr SVEN KJÄR's apparatus for condylar osteosynthesis

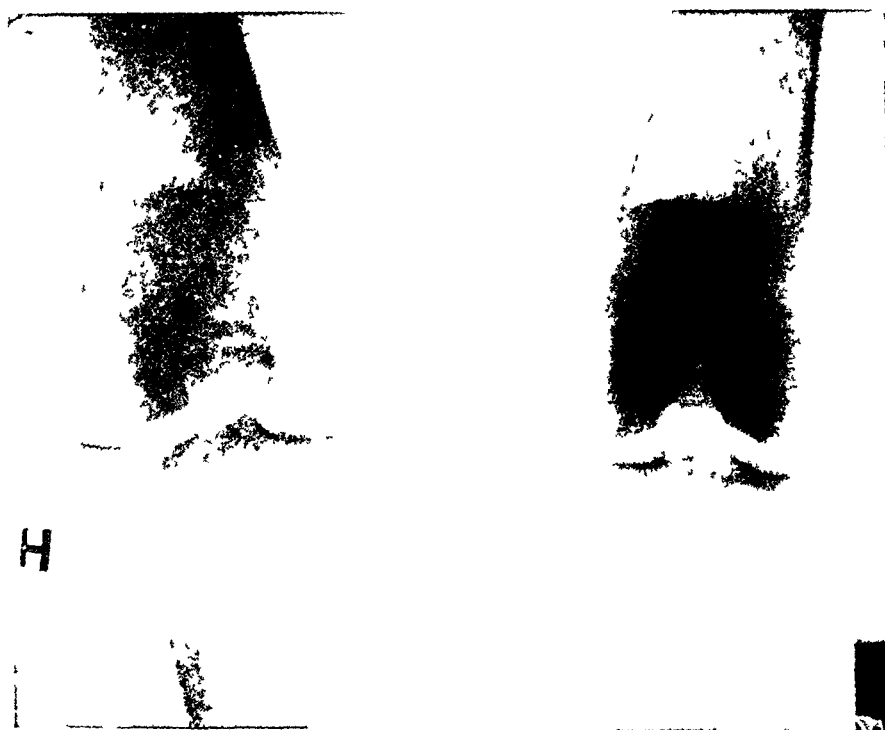


Fig 2 Fracture of the lateral condyle of the tibia with latitudinal displacement in Case 4, prior to osteosynthesis

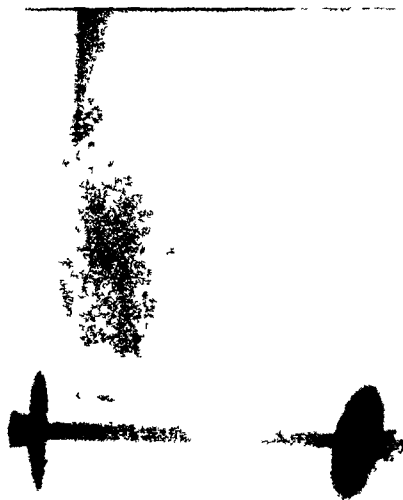


Fig. 3 Same fracture as in Fig. 2, immediately after osteosynthesis



Fig. 4 Same case as in Fig. 2 on reexamination 2½ years later

*Case 4 (Table 5)*

Man, aged 61, stoker Adm  $^{10}/_1$ — $^{25}/_2$  and  $^6/_7$ — $^{17}/_7$  1941 (Record No 2563/41)

Diagnosis Fracture of the lateral condyle of the right tibia, Fracture of the neck of the right fibula

Immediately before admission, the patient was kicked on the outside of the knee by his horse

Physical examination showed a considerable swelling of the right knee with tenderness corresponding to the lateral condyle of the tibia and the neck of the fibula

Roentgenography (Fig 2) Console fracture from the middle of the articular surface of the lateral condyle of the tibia with perpendicular break of the continuity Lateral displacement of 0.7 cm Fracture of the neck of the fibula, without displacement

$^{15}/_1$  41 Under spinal anesthesia, osteosynthesis of the tibial condyle ad modum KILÆR

Roentgenography (Fig 3) Displacement abolished

Subsequent course uncomplicated

$^2/_7$  41 Removal of the osteosynthesis bolt

Reexamination,  $^{28}/_8$  43 He resumed his work  $1\frac{1}{2}$  years after the accident He was granted a compensation of 500 Danish crowns (15 % disability) Since then, he has changed occupation (he is now janitor), as he could not keep up the rate of work as stoker He has no complaint whatever, and he presents no signs of any affection (For details, see Table 5)

Roentgenography (Fig 4) Osseous healing of fracture with horizontal articular surface Insignificant depression of the articular surface of the lateral condyle Intercondylar eminence a little pointed

*Result* Clinically and roentgenographically good

The average duration of the stay in the hospital was 63 days, including the readmission for removal of the bolt

*Complications* — After the operation one patient (No 7) had pulmonary infarction — probably from pelvic phlebitis Local complications involving the knee-joint or the bony tissue in the form of otitis pressure necrosis were not observed On removal of the bolt, as a form of routine examination, cultures were made from the site of the osteosynthesis In no instance did these cultures show bacterial growth

*Therapeutic Results*

The *immediate anatomical result* of the operative treatment was in every case a distinct improvement or complete abolition of the displacement Roentgenologically the result of the operative reposition has to be characterized as good in 9 cases (Nos 1—8

and 11), considerable improvement of the position in 3 cases (Nos. 9, 10 and 12). For additional details see Table 4. Reposition of the latitudinal displacement was feasible in practically every case. On the other hand, the depression could not be overcome in every instance — nor was that to be expected, indeed, as the apparatus here employed is aimed chiefly to remedy the latitudinal dislocation.

Table 4  
*Results of Operative Treatment*

Pt No	Immediate anatomical result	Late result	
		Functional	Anatomical
1	Good	Good	Good
2	Good	Good	Good
3	Good	Good	Good
4	Good	Good	Good
5	Good	Good	Good
6	Good	Good	Good
7	Good	Good	Fair
8	Good	Good (immediate)	Not examined
9	Improved	Good	Fair
10	Improved	Fair	Fair
11	Good	Poor	Poor
12	Improved	Poor	Fair

The *late result* may be estimated on the basis of the entire operative patient material. In one of these cases (No. 8) our information about the late result is only secondhand, it is true, but the immediate anatomical and clinical result at his discharge from the hospital was satisfactory. The remaining 11 patients were all reexamined and roentgenographed after an observation period of from  $\frac{1}{2}$  to 6 years. For 9 patients the observation period was over  $1\frac{1}{2}$  years.

Here particular importance has to be attached to the functional result (see Tables 1 and 5). In 8 patients (Nos. 1—7 and 9) this was *good*, meaning full capacity for work in the usual occupation (but one patient, No. 4, had to change occupation), absence of pain in the knee region (apart from possibly preexisting rheumatism), no complaints concerning mobility and gait and only slight

or no complaint of tiredness Further, *objectively* no deformity (apart from possibly preexisting) of the knee region No accumulation of fluid in, or swelling of, the knee, free mobility in the joint (except perhaps for an insignificant defect in flexion), no crepitation or grinding in the joint beyond the state of the other knee, no tenderness on pressure or external laxity, physical force as on the normal side, no atrophy, no disturbance of the gait attributable to the condylar fracture, and no need of a cane or similar support

So out of 11 patients these 8 are practically completely symptom-free, subjectively as well as objectively With one exception (No 4, case of insurance compensation) all these patients were soon — at once or within a few months — able to resume work as before

One additional patient is to be reckoned in this group (No 8) although detailed information is wanting in his case, but he is stated to be fully able to work in a peat-bog

A *functionally fair late result* was obtained in one patient (No 10), meaning merely partial capacity for work, moderate complaints about the knee, considerable defect in flexion, impairment of the strength of the leg A *functionally poor late result* was found in 2 cases (Nos 11 and 12), this estimate being based on the following symptoms complete or partial incapacity for work severe complaints of pain, limitation of movements, difficulty in walking, markedly defective flexion or extension, impairment of the strength of the leg, and necessity of a cane for support

Here it will be appropriate to say something about the causes of the fair or poor late results In one case (No 11) this outcome was due to *erroneous treatment* This patient, a woman, in whom the immediate anatomical result was particularly good, was allowed through a regrettable mistake to place her weight on the operated leg as early as three weeks after the operation, which immediately resulted in reproduction of the dislocation of the bicondylar fracture In her case the observation period is still too short for any definite statement about the late results, but even though she is still improving, in view of the roentgenologically poor position of the fracture the clinical result is not likely to be good

In Patient No 10 the shortcoming of the functional result is attributable essentially to the homolateral comminuted fracture of the proximal part of the crus, which healed in varus position Furthermore, on her return home this patient had at once to take

Table  
*Schematic Survey of Patients receiving Operative*

Patient No	Age	Occupation	Fracture	Complications	Able to work after	Period of observation	Complaints			
							Pain	Limitation of mobility	Disturbances of joint	Interferences
1	41	Housewife	Lateral condyle	0	At once	6 years	0	0	0	0
2	61	Scavenger	Bicondylod	Fracture of neck of tibia	1 month	4 $\frac{3}{4}$ yrs	0	0	0	0
3	51	Housewife	Lateral condyle	Obesity	2 mths	3 yrs	0	0	0	0
4	61	Stoker	Lateral condyle	Fracture of neck of fibula	1 $\frac{1}{2}$ yrs (compensation)	2 $\frac{1}{2}$ yrs	0	0	0	0
5	38	Canner (female)	Lateral condyle		3 mths	1 $\frac{3}{4}$ yrs	0	0	0	0
6	14	Schoolgirl	Medial condyle		At once	4 yrs	0	0	0	0
7	73	Housewife	Lateral condyle	Bilateral arthrosis of knee Angina pectoris	1 $\frac{1}{2}$ yrs	4 $\frac{1}{2}$ yrs	2	0	0	—
8	52	Messenger	Lateral condyle			On discharge	0	+	—	—
9	44	Housewife	Bicondylod	Concussion of brain	1 $\frac{1}{2}$ year	1 $\frac{3}{4}$ yrs	0	0	0	—
10	71	Housewife	Lateral condyle	Fracture of proximal part of crus Scimitry	Partial	2 $\frac{1}{4}$ year	(+)	+	—	—
11	56	Housemaid	Bicondylod	Fracture of intercondylod eminence Heart lesion	Partial	1 $\frac{1}{2}$ year	—	—	—	—
12	47	Nurse, pensioned	Medial condyle	Complicated supramalleolar fracture Bilateral habitual dislocation of patella Asthma	Not yet	2 $\frac{1}{2}$ yrs			Arthro	

<sup>1</sup> 2 cm shortening of the leg from the tibial fracture

<sup>2</sup> Rheumatism of both knees prior to accident

5

### *Treatment and Results obtained on Reexamination*

Objective findings									
Deformity	Swelling	Mobility	Crepitation	Tenderness	Emphy	Strength	Atrophy	Gait	Cane or other support
0	0	Free	0	0	0	Good	0	Normal	0
+ (poly arthritis)	0	—15° flexion	0	0	0	Good	0	Slight limp <sup>1</sup>	0
0	0	Free	0	0	0	Good	0	Normal	0
0	0	Free	0	0	0	Good	0	Normal	0
0	0	Free	0	0	0	Good	0	Normal	0
0	0	Free	0	0	0	Good	0	Normal	0
— <sup>2</sup>	0	—15° flexion	+ <sup>2</sup>	0	0	Good	0	Normal	0
0	+	180°—110°	0	0	0	Low-ered	0	Normal	+ cane
0	0	Free	0	(+)	0	Good	0	Normal	0
0	0	180°—90°	0	+	0	Low-ered	0	Normal	0
+	+	170°—120°	0	(+)	0	Low-ered	0	Slight limp	+ 1 cane nor mal gait
desis of the knee									



care of her helpless husband (82 years old) and in addition she was very senile herself (Observation period only 6 months)

In the case of the last patient (No 12), other very serious affections were present at the same time namely homolateral complicated comminuted, supramalleolar fracture and habitual dislocation of the patella The anatomical result of the condylar fracture of the tibia was fairly satisfactory, but somehow the exercise of her quadriceps femoris was not successful This patient was a nurse 47 years old, already retired and pensioned, of an extremely asthenic habitus In her case it was necessary later to aim at arthrodiesis of the knee by immobilization in plaster cast

It will further be noticed that in the two cases with poor late result the fractures were of the type of tibial fractures which by experience is known to imply the poorest prognosis, namely bicondylar fracture and fracture of the medial condyle, in the former case associated with an additional fracture of the intercondylar eminence

With regard to the *late results anatomically* the outcome of the operative treatment can be estimated in 11 patients on the basis of X-ray control

In 6 cases (Nos 1—6, see Table 4) the result has to be characterized as *good* meaning that the roentgenograms showed obvious union and healing of the fracture in normal position or with an insignificant increase in the joint gap, corresponding to a slight depression of the condyle involved In these 6 patients also the immediate anatomical result was good, and clinically they were all symptom-free

In 4 cases the X-ray examination showed a *fair anatomical result* (Nos 7, 9 10, 12) meaning greater irregularity of the articular surface of the tibia arthrosis or slight increase in the width of the condylar area

In one case (No 7) the cause of this could not be demonstrated The immediate anatomical result was perfect and the late functional result was good But the patient was 73 years old and was beforehand suffering from bilateral arthrosis of the knee joint

In patient No 9 the roentgenologically inferior late result was in keeping with the fact that the reposition of her comminuted bicondylar fracture was not quite precise The same applies to No 10, in whom the inferior result, roentgenologically as well as clinically, was attributable chiefly to the varus position of the intracondylar fracture

Also in No 12 the reposition was not precise, and the late result showed similar roentgenological features. As mentioned before, however, the poor clinical result is hardly attributable to this shortcoming but rather to functional insufficiency of her quadriceps.

In one patient (No 11) the late result was poor anatomically. As mentioned before, this is ascribable to faulty treatment as, by mistake, this patient was allowed to put her weight on the leg as early as three weeks after the operation which resulted in redisplacement.

All told, with precise reposition the late result was good, roentgenographically as well as clinically, in 6 out of 11 cases. A fair or poor anatomical late result was observed in 5 patients, in 3 of whom the clinical result was likewise fair or poor. So, even though experience — and this applies to the present material too — shows that the functional result may be good regardless of the anatomical foundation, this account illustrates that when anatomical reposition can be maintained it proves of great value to the clinical late result.

The value of a comparison between the results obtained in this department by operative treatment and a conservative treatment of condylar fractures will naturally be limited by the fact that the fractures in the two groups differ in severity. In the group of operative treatment all the cases were severe or rather severe, often associated with other dominating traumatic injuries to the same extremity. The cases in which conservative treatment was employed represent on an average the milder forms within the entire material. It may be of some interest, however, to tabulate the two groups together, both for comparison of certain features and in order to get an impression of the prognosis of condylar fracture of the tibia in general.

### Conservative Treatment.

This group comprises 29 patients, 16 men and 13 women. The age distribution of these patients and the pathological-anatomical aspects of the fracture are given in Tables 1—3.

Of these patients, 13 presented a fissure or fracture in normal anatomical position, while 3 showed displacement to the side alone, 9 presented depression alone, and 4 showed a combination of latitudinal increase and depression, in one there was only eleva-

tion of the condylar fragment. All the fractures were uncondylar. In all the patients with latitudinal displacement of the fracture this was so moderate that osteosynthesis was not considered indicated. Exceptions to this rule, however, were found in four patients with considerable latitudinal displacement. As mentioned already, these patients were not given operative treatment because of contraindications (phlebitis in two of them, while the remaining two were admitted so late that the fracture was consolidating or had consolidated already).

With certain individual modifications, the following principles were followed in the conservative treatment:

Confinement to bed, in the presence of hemothrom, arthropuncture with aspiration, and immobilizing bandage for a few days. Then discontinuance of immobilization and rapid mobilization of the knee through active and passive motions + massage, particular stress being laid upon exercise of the quadriceps musculature. The patient — this applies in particular to the elderly — is allowed to get up and sit in chair within 8—14 days after the accident. About 6 weeks after the accident — with incomplete fracture a little earlier, with displacing fracture of the medial condyle a little later — the patient commences cautiously to put weight upon the leg, at first in perambulator, later with the use of crutch-canes, and gradually with the support of an ordinary cane.

Of *complications*, phlebitis of the lower extremity involved occurred in 4 cases. One of these patients had pulmonary embolism and died 38 days after admission.

*Late results* — Of the 29 patients given conservative treatment, 22 were reexamined after an observation period of from 6 months to 5 years. Of the remaining 7 patients, 1 died here in the hospital, 1 died later on, and 5 failed to return at our request for reexamination.

Estimated after the same principles as employed for the patients who were given operative treatment, the late results obtained in this group were judged as recorded in Table 6.

Table 6

*Late Results of Operative and Conservative Treatment*

	Good	Fair	Poor
Operative treatment	9	1	2
Conservative "	16	5	1
Total	25	6	3

From Table 6 it will be noticed that the result was good in 16 cases, fair in 5, and poor in 1. For comparison, the functional late results are given also for the group of patients treated operatively.

For the *total material*, comprising altogether 34 reexamined patients, the late results were good in 25 cases (about 74 %), fair in 6 (about 18 %), poor in 3 (about 9 %).

On comparison of the late results obtained in the two groups — with the aforementioned reservations — there is no great difference. Considering the two categories “fair” and “poor” under one as unsatisfactory, the late results in the operative and the conservatively treated patients appear to be strikingly alike.

As a review of the entire material reveals no factor — especially not with regard to age or occupation — that may be taken as favorable to the group of patients who were given operative treatment, but rather the contrary, the outcome may hardly be interpreted otherwise than indicating that the operative intervention has brought a group of patients with the prognostically worst fractures up to the level of another group of patients with lighter fractures and therefore better prognosis.

To me, this appears to be the practical consequence, which speaks in favor of operative treatment in suitable cases.

### Conclusive Remarks.

Finally I shall try briefly to point out what an analysis of my own material together with a review of the rather extensive literature has taught me about the treatment of condylar fractures of the tibia.

Since these forms of fracture at the end of the last century commenced to attract attention in the literature, the principles of their treatment have gradually undergone some modification. Up to a couple of decades ago a majority of the authors took a most conservative stand, and operative treatment was employed only in very few cases. But about the middle of the twenties, more radical views began to assert themselves. An increasing number of good results from operative treatment were reported, the surgical methods improved, and — as is quite evident from the literature of the last decade — now by far the most authors agree that operative treatment is justified in certain fractures of this kind.

It is the general consensus of opinions that light fractures of this kind with only slight displacement or none at all should be treated conservatively while fractures with relatively marked displacement ought to be treated operatively if manual or bloodless instrumental reposition turns out unsuccessful. Nearly all authors harmonize in the view that precise reconstruction of the articular surface of the tibia is of great significance to the final result.

This change in the recognition of the therapeutic indications which probably has been associated with the rapid development of and interest in the treatment of fractures in general during the last couple of decades, has altered the prognosis of these fractures which previously was considered rather poor while now most authors take it to be relatively good. Still, even in our days, good results are being reported from conservative treatment exclusively.

The principles which I think may be pointed out — and which I shall try to follow myself — especially the question about the range of indications and methods for operative treatment are as follows: a relatively marked displacement — an increase in width over 0.5 cm. or a smaller depression — ought to be corrected operatively if bloodless reposition cannot be effected with sufficient accuracy.

In strictly latitudinal displacement the bolting method may be recommended as a simple, easy and reliable method. In several cases also a moderate depression of the condyle may be corrected by this measure. When latitudinal displacement is combined with a more pronounced depression, I think, the reposition ought to be performed with arthrotomy, in order to ensure precision under the guidance of vision — also with a view to the rather many cases of meniscal injury with interposition described in the literature.

In most cases, however, establishment of the reposition by metallic osteosynthesis will be advisable. In strictly depression fractures, indicating operative treatment, this measure is undoubtedly to be recommended under arthrotomy with elevation of the fragment and stabilization by osteoplasty.

In operative treatment of bicondylar fractures with longitudinal displacement of the fibril shaft up between the condylar fragments the reposition ought to be performed under simultaneous extension. Compression of the condylar area alone is not enough, nor extension alone. Undoubtedly the combination of extension and compression — for instance, by bolting — will prove to be the proper treatment.

The criticism to which our treatment of these fractures is subject, is rather obvious. We have not individualized the treatment enough. We have tried chiefly to gain experience with a single method for bloody reposition and retention, and hence we have to some extent employed it beyond its range of serviceability. There is a definite range of indications for bolting, in which this measure is fully adequate. No doubt, the results from bolting may be better yet. For one thing, in a few cases we have omitted to correct a not altogether accurate reposition. Furthermore — and presumably this is far more important — trusting in the osteosynthesis we have let the patient put weight upon his leg too early. This is erroneous — no doubt about that. Bolting has the advantage that it does not prevent the significant early mobilization, but it does not allow weight to be put on the leg early.

Our treatment of condylar fractures with bolting after the KILÆR method has also been a sort of experimental study from which we have gained some experiences. The application of these experiences to the future treatment may reasonably be expected further to improve the prognosis in condylar fracture of the tibia.

### Summary.

Of 41 patients with condylar fracture of the tibia 12 were given operative treatment — in 11 of these cases with bolting *ad modum* KILÆR.

The operatively treated patients represent the most severe forms of this kind of fracture in the present material.

The immediate anatomical result was good in 9 of these cases, while improvement was recorded in 3.

Functionally the late results were good in 9 cases, fair in 1, and poor in 2.

Anatomically the late results were good in 6, fair in 4, and poor in 1.

The method is recommended for treatment of condylar fractures of the tibia with considerable latitudinal displacement.

### Zusammenfassung.

Von 41 Patienten mit *Fractura condyli tibiae* wurden 12 operativ behandelt, 11 von diesen mit Verschraubung a m Sv KILÆR.

Die operativ Behandelten stellen die schwersten Frakturformen in diesem Patientenmaterial dar

Das unmittelbare anatomische Ergebnis ist bei 9 Patienten gut, bei 3 gebessert

Das Spätergebnis ist in funktioneller Hinsicht gut für 9, weniger gut für 1 und schlecht für 2

Das Spätergebnis ist in anatomischer Hinsicht gut für 6, weniger gut für 4 und schlecht für 1 Patienten

Das Verfahren ist zur Behandlung von Spaltfrakturen mit grosserer Seitenverschiebung zu empfehlen

### Résumé.

Parmi 11 sujets avec fracture de condyle tibien il y a 12 qui reçoivent un traitement opératoire, et 11 de ceux-ci avec embochement à la manière de SV KIER

Les sujets opérés représentent les formes de fracture les plus graves de ce matériel

Le résultat anatomique immédiat est bon pour 9, amélioré pour 3 sujets

Les résultats permanents à l'égard de la fonction sont bons pour 9, moins bons pour un, et mauvais pour 2 sujets

Le résultat anatomique permanent est bon pour 6, moins bon pour 4 et mauvais pour un sujet

La méthode est recommandée pour le traitement de fractures avec dislocation latérale assez grave

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From the Surgical Department of the Lund University Hospital  
(Surgeon in-chief Prof J P STROMBECK)

## On the Bacteriologic Features of Panaritia and a Number of Other Inflammatory Processes Encountered in Minor Surgery.

By

HELGE B WULFF, M D

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From a therapeutic standpoint it was previously of minor interest to the work in a surgical out-patient department to have a detailed bacteriologic diagnosis in cases of panaritium, phlegmon, infected wounds, furuncles, mastitis, and the like. Only in occasional special cases was a knowledge of the bacteriologic conditions necessary for the institution of suitable therapy. Thus NICHOLAYSEN published two cases of panaritium in 1935, in one of which the infection was caused by *B. fusiformis* and in the other by a spirochete, and which showed no signs of healing until after the administration of salvarsan. And in a number of cases of sodoku (rat bite fever) published in Sweden by RYDÉN, STROMBECK and SMITT, it was not until after the special nature and bacteriologic features of the infection was realized that appropriate therapy — neosalvarsan — could be instituted, with rapid and complete cure as the result.

However, the introduction even into out-patient practice of the now so widely used chemotherapeutic compounds and the indubitable advantages thereof, make a bacteriologic cataloguing of the infecting agents in the ordinary cases coming to a surgical out-patient clinic desirable. This is particularly so, because, judging from the scanty literature on the subject, the bacteriologic conditions seem to vary with the origin of the cases, according to whether they come from urban, rural or industrial districts (BINDER, W. MULLER). No extensive investigation of this kind seems to have been done previously in Sweden.



Obviously, it is particularly interesting to learn the bacteriologic conditions in cases of paronychia, which are of such importance in general practice. This communication also touches upon the connection between the kind of bacteria and the time taken for healing.

### Cases

The series on which this study<sup>1</sup> is based is comprised of about 400 cases from the Surgical Out-patient Department of the Lund Hospital and covers paronychia, phlegmons, abscesses, infected wounds, mastitis, hydroadenitis, furuncles and the like. Thus it presents a sample collection of the cases of inflammation which are an everyday occurrence at a surgical out-patient department. The cases are taken from the period June 1, 1940 to Dec. 1, 1941. The main occupations of the patients were farming and household work. Only a few of them came from industrial districts.

The bacteriologic examinations were all done by expert bacteriologists (Bacteriologic Institute in Lund, Professor A. LINDBÄCK). In all the cases the diagnosis was made after *culture* on suitable media and in all of them it was a question of pathogenic bacteria.

### What Bacteria are Present Normally on or inside the Body?

It is a well known bacteriologic fact that some parts — the most exposed — of the human organism take up bacteria of different kinds from other living or dead material with which they come in contact. Most of these bacteria do not grow on their host and so each part of the body maintains its own, and in some cases very characteristic, bacterial flora. Staphylococci and diphtheroid bacilli, however, seem to occur over the whole surface of the body. In the superficial air passages, on the other hand, non-hemolytic streptococci and pneumococci not seldom occur normally. Non-hemolytic streptococci and several forms of spirochetes are also found in the oral cavity. In the alimentary tract, specially in its distal regions, *B. coli*, *B. proteus* and *B. pyocyaneus* are the dominating organisms. In the external genitalia the most common bacteria are *B. coli*, gram-positive cocci and a number of spirochetes.

<sup>1</sup> A preliminary report was presented in the fall of 1941 at a meeting in Lund of the Swedish Surgical Society.

This summary recapitulation of the bacteria which occur *normally* in the regions of the body where most of the inflammatory processes encountered in out-patient cases are found, serves as a background for the bacteriologic analysis made in the present series

### Bacteriologic Observations in Surgical Out-Patient Cases.

What kinds and combinations of bacteria are then found in the usual cases coming to surgical out-patient clinics? This question is answered in figure 1, where not only the different bacteria are registered but also their relative frequency

As seen there, the hemolyzing, plasma-coagulating staphylococci, (hereafter called staphylococci only), are by far the most common organisms in this series of external inflammatory processes. In more than 85 per cent of the cases they were the sole agent of the inflammation, a condition generally noted in other similar investigations (BINDER, MULLER, BRUNNER) and which is probably explained by the occurrence of staphylococci normally on the skin surface. But the staphylococci do not always dominate to the same extent in the separate types of inflammation, as seen from BINDER's (Hamburg) study of panaritium, often of severe nature (seamen), where streptococci played a much larger part in certain groups.

The hemolytic streptococci (hereafter called streptococci only) play only a small part, quantitatively, in my series, appearing to be the sole infecting agent in only 4.6 per cent of the cases. But in several cases they produced very serious inflammation.

As regards the relationship between mono-infection and poly-infection, analysis reveals that mono-infection occurred in more than 90 per cent of the cases. In 3.9 per cent there was a mixed infection with hemolytic streptococci and hemolyzing, plasma-coagulating staphylococci, while in 3 per cent there were a number of different combinations of *B. coli*, paracolon bacillus, *B. proteus*, *Pneumococcus* and *Str. viridans*. The remaining 1.9 per cent were due to mono-infection with *B. coli*.

Judging from other investigations, however, the frequency of mixed infections varies to a considerable degree. While in BINDER's material it amounted to 14 per cent, in SULAMAA's (Helsingfors) cases of similar injuries, treated according to LOHR it is true, the frequency amounted to nearly 80 per cent.

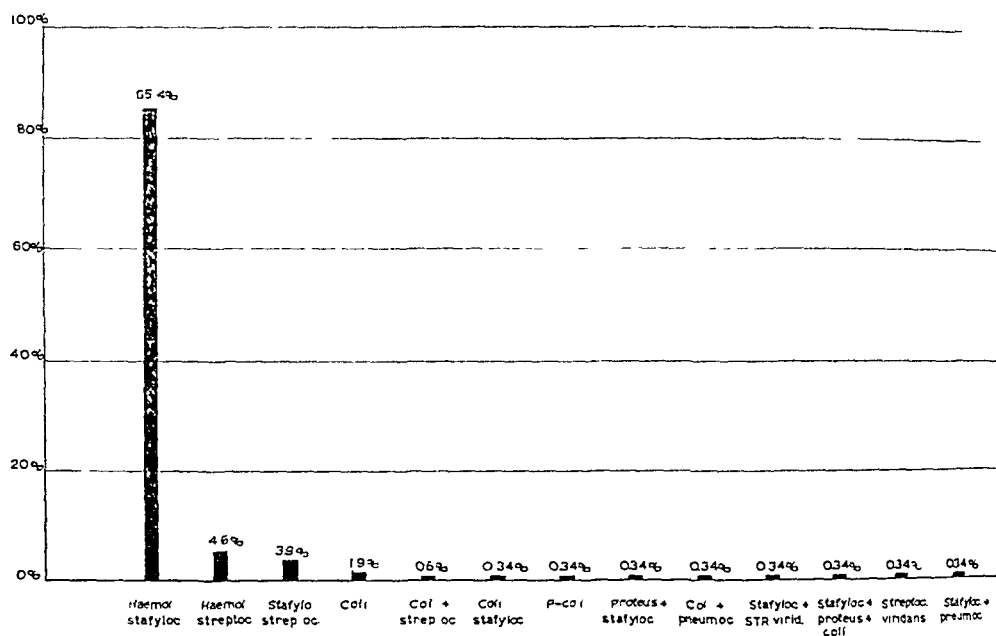


Fig 1

The foregoing data give an idea of the composition of and variations in the bacterial flora in ordinary out-patient cases. But it is also interesting to learn about the nature of infecting agents in special, relatively delimited groups of disease — panaritium, mastitis, hydro-adenitis, furuncles, etc — and about the occurrence of mono-infection and polyinfection within these groups.

### Superficial and Deep Panaritium (130 Cases)

The bacteriologically analyzed cases of superficial and deep panaritium in my series amount to 130, 15 of which represent different kinds of deep panaritium (articular, tendinous and osseous panaritium). Figure 2 shows the occurrence of the different forms of bacteria in the different groups as well as their percentage distribution.

As seen, the infection in 89.6 per cent of the cases of *superficial panaritium* was produced solely by staphylococci (*Staphylococcus aureus*), while in 4.3 per cent only streptococci were obtained on culture. The latter cases did not differ markedly as regards development, symptoms and clinical course from the ones of superficial panaritium due to staphylococci. In two of the

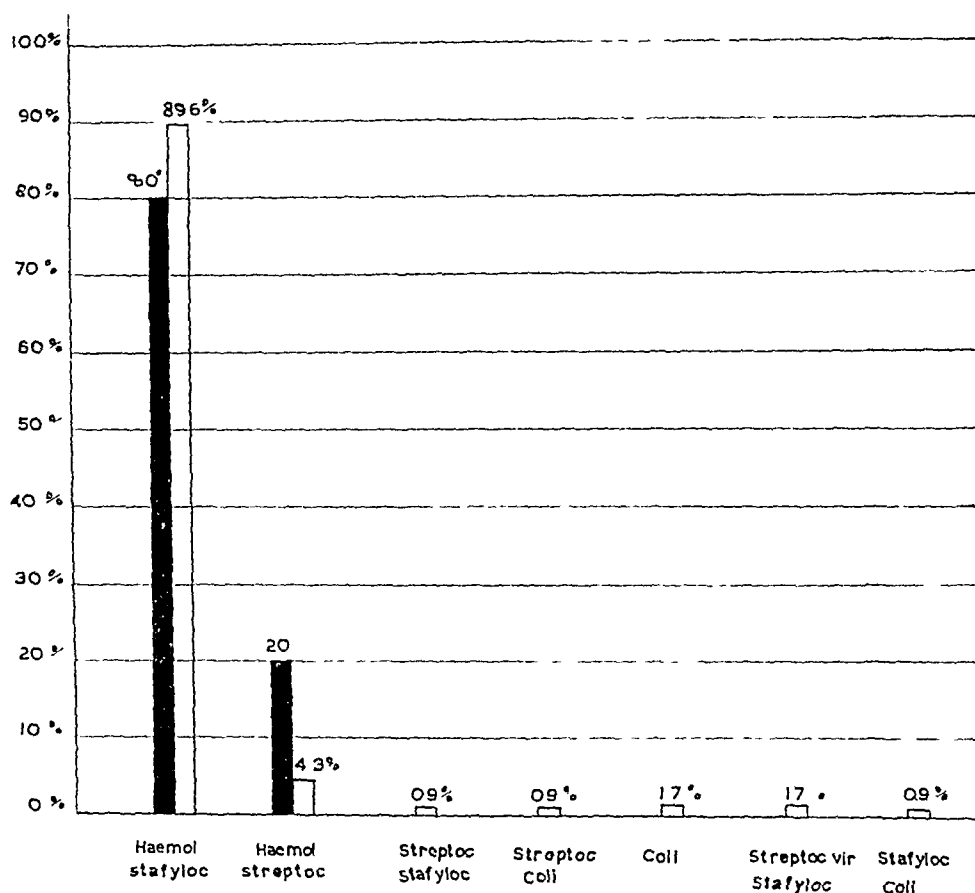


Fig 2

streptococcic cases the patient was employed in a hospital and in another in the butcher industry

Mono-infection with *B. coli* was observed in two instances, or 1.7 per cent (in a veterinary and a dishwasher). A number of mixed infections were also represented. In one case (cattlehand) streptococci were combined with *B. coli*, in another (hospital employee) staphylococci with *B. coli* and in a third streptococci with staphylococci. In a fourth and fifth case, there was a mixture of staphylococci and *Str. viridans*. In both of the latter cases there was a phlegmon of the nail fold, and the occurrence of *Str. viridans* might have been due to biting of the nails.

As seen, the dominating bacteria in cases of superficial panaritium were staphylococci — in the form of mono-infection. Only in about 10 per cent were other kinds of bacteria, alone or combined with others, the cause of the infection.

The conditions appear to have been about the same in series reported by other authors. Thus staphylococci were responsible for the infection in 65 of BINDER's cases of superficial panaritium, streptococci in 6 cases and a mixture of bacteria (streptococci, staphylococci and *B coli*) in only 7 cases.

The bacterial conditions in my cases of *deep panaritium* (ossal, articular and tendinous panaritium) were fairly similar to the ones just related. Only mono-infection was found in this group, but reservation must be made for the small number of cases (15). In 12 cases the infecting agents were staphylococci (*Staphylococcus aureus*) and in 3 cases streptococci. The latter three cases were extremely severe, with involvement of the tendon sheaths high up in the musculature of the forearm.

In BINDER's cases of this kind, staphylococci were responsible for 75 per cent, while in 25 per cent there was a mixed infection (streptococci and staphylococci). In a fairly large series of cases of tendinous panaritium, on the other hand, BINDER observed a considerable predominance of streptococci (75 per cent). Culture yielded staphylococci in only 20 per cent and a mixture of bacteria in 5 per cent. In my small series of this nature, staphylococci and streptococci were about evenly distributed.

Bacteriologic analysis in a relatively large number of other surgical cases with external inflammation gave results partly agreeing with earlier observations. They will now be briefly described, however, so that the survey will be as representative as possible of this out-patient clientèle.

### Furuncles and Carbuncles (97 Cases).

Bacteriologic analysis revealed staphylococci in 97 per cent of my cases of furuncles and carbuncles, numbering about a hundred. Infection with *B coli* was noted in one case (farmhand with an apparently ordinary furuncle on the forearm). Polyinfection was observed in only one case (staphylococci, *B coli* and *B proteus*, furuncle in the vestibulum nasi).

### Abscesses and Phlegmons (33 Cases).

Regional grouping seems to be suitable for cases of abscesses and phlegmons. In the cases involving the oral cavity and pharynx,

especially in alveolar periostitis, streptococci were the most common organisms (*Str viridans* in 2 cases, *Sti salvarius* in 2 cases and ordinary hemolytic streptococci in only one case) Only in three cases was the infection caused by staphylococci and in one of them there was an apparently ordinary alveolar periostitis

Abscesses in the anal region and proximity showed a greatly variegated bacteriologic picture *B coli* alone or combined with streptococci and staphylococci was the commonest observation In two cases, where the clinical picture pointed to the possibility of furuncle, only staphylococci were found

In cases of erysipelas with necrosis, culture also yielded hemolytic streptococci, and in one case of progressive skin gangrene, aerobic and anaerobic culture showed only a polyinfection with staphylococci and streptococci

Thus, judging from the observations in this series, staphylococci play only a slight part in inflammation in the aforementioned regions

### **Bursitis, Infected Hematoma and Lymphadenitis (21 Cases)**

Mono-infection with staphylococci was present in all the cases of bursitis There were 5 cases of infected hematoma in different situations and in 3 of them the infection was due to streptococci and in 2 to ordinary staphylococci

The cases of lymphadenitis presented different kinds of bacteria, most commonly staphylococci The cases of lymphadenitis in the jaw region showed, not unexpectedly, *Str viridans* In one case there was an ordinary streptococcal infection

### **Infected Wounds (Contusions, Cuts, Blows, Bites, Gunshot Injuries, etc., 34 Cases).**

Wound infections of this kind were most often caused by staphylococci (28 cases) Streptococci were found in 3 cases, one of which followed injury by a meat bone In the other 3 cases, different kinds of polyinfection were present, in one instance a combination of staphylococci and *B proteus* (infection after cut by butcher knife), and in the second and third a mixture of staphylococci with streptococci and the paracolon bacillus, respectively

These wounds represent peace-time wounds and probably show a fairly normal bacterial flora for such conditions. War injuries may present other bacteria, as seen by the cases of MARVEDEL, PFEIFFER and HEVROWSKI, where streptococci dominate. On the other hand, experience from the present war in Central Europe, according to FRANZ, indicates that staphylococci are at least as much responsible for infection as streptococci.

### .. Mastitis, Hydro-Adenitis, Infected Atheromas and Dermoid Cysts, Impetigo, etc. (80 Cases)

The cases of acute septic mastitis showed only *Staphylococcus aureus*, and likewise the cases of hydro-adenitis. In a large number of other inflammatory processes of different types and localizations, culture produced plasma-coagulating, hemolyzing staphylococci. Streptococci occurred only in a few instances. Mono-infections were present in all these cases.

Only one polyinfection was registered. An 87-year-old man came to the Surgical Out-patient Service for multiple ulceration and vesiculation of nonspecific type on the hands. Culture yielded a mixture of *B. coli* and *Pneumococcus* type III. Local and internal treatment with sulfathiazole led to rapid disappearance of the lesions.

The bacteria occurring normally on the skin surface and elsewhere in the body were described in the beginning of this paper, and attention was drawn to the preponderance of staphylococci. The bacteriologic cataloguing, done after culture on suitable media, of about 400 cases of external surgical inflammation shows that the bacteria correspond on the whole with those normally present in the respective regions. The deviations observed are in many cases explained by the special working conditions of the patient (veterinary, hospital, butcher, barnyard work, etc.).

*In more than 85 per cent of all the cases the inflammation was caused by hemolyzing, plasma-coagulating staphylococci (nearly always Staphylococcus aureus) and in about 5 per cent by hemolytic streptococci. The remaining 10 per cent showed mono-infection with other bacteria and polyinfections.*

## Is There a Definite Connection Between the Kind of Bacteria and the Time Taken by the Infection to Heal?

Surgeons often say that one or the other bacteria causes milder or severer inflammation. How are these assumptions supported by the present bacteriologic analysis of cases of external inflammation treated at a surgical out-patient department?

If one takes the time of healing as a criterion of the severity of the process — a method which is naturally both rough and uncertain in many respects — and compares all the cases of staphylococcic origin with the ones of only streptococcic origin, it is seen that the healing process took  $14.3 \pm 2.1$  days in the staphylococcic cases, i. e., between 10 and 18 days<sup>1</sup> on the whole, and  $23.9 \pm 7.7$  days, i. e., between 8 and 39 days, in the streptococcic cases. The difference between the two groups is not statistically significant, but the tendency of streptococci as such to cause inflammation of slower healing is fairly obvious, even though other factors, such as differences in power of resistance, the treatment and the heterogeneity of the material, might have been of influence.

If the same comparison is made in a purer and more homogeneous material, i. e., the delimited group of inflammation covered by the cases of panaritium, it is seen that the healing took  $15.4 \pm 3.3$  days (9 to 22 days) in the 115 cases where the infecting agent was a staphylococcus and  $38.0 \pm 9$  days (20 to 56 days) in the 15 streptococcic cases. The difference between these two groups is almost statistically significant.

Thus the hemolytic streptococci as such seemed to cause more severe processes in the respective regions than the hemolyzing, plasma-coagulating staphylococci. This would indicate that there is some connection between the kind of infecting bacteria and the time taken by the inflammation to heal.

### Summary.

Bacteriologic culture in about 400 cases of panaritium, phlegmon, abscess, mastitis and other similar conditions encountered in minor surgery showed that in more than 85 per cent the in-

<sup>1</sup> if two times the standard deviation is taken



fecting organism was a hemolyzing, plasma-coagulating staphylococcus (*Staphylococcus aureus*) Hemolytic streptococci were found in 5 per cent, and mixed infections in 10 per cent

In 90 per cent of the cases of superficial panaritium staphylococci were found, in 4 per cent streptococci and in about 6 per cent polyinfection. In 80 per cent of the cases of deep panaritium staphylococci were found and in 20 per cent streptococci

Comparison of the gravity of the inflammation caused by different sorts of bacteria would indicate that streptococci as such caused a more severe process (longer time of healing) than staphylococci or polyinfections

### Zusammenfassung

Eine mittels Zuchtung bewerkstelligte bakteriologische Analyse der Bakterienflora bei etwa 400 Fällen von Panaritien, Phlegmonen, Abszessen, Mastitiden u. a. m. ergab, dass in über 85 % der Fälle die Entzündung durch einen hämolysierenden, plasma-koagulierenden Staphylokokkus (*Staph. aureus*) hervorgerufen war, nur in 5 % wurden hämolytische Streptokokken gefunden, während in 10 % der Fälle Polyinfektionen vorlagen

Bei *oberflächlichen* Panaritien waren Staphylokokken in 90 % Streptokokken in 4 % und Polyinfektionen in etwa 6 % der Fälle vorhanden. Bei *tiefen* Panaritien war die Verteilung 80% Staphylokokken und 20 % Streptokokken

Was die Schwere des entzündlichen Vorganges bei den einzelnen Erregerarten betrifft, so scheinen die Streptokokken als solche schwerere Entzündungsformen (was die Heilungsdauer betrifft) hervorzurufen, als die Staphylokokken oder die Polyinfektionen

### Résumé

Une analyse bactériologique par cultures de la flore microbienne d'environ 400 cas de panaris, phlegmons, abcès, mastites etc. a montré que dans plus de 85 % des cas l'agent provoquant l'inflammation était un staphylocoque hémolytique et coagulateur du plasma (*staphylococcus aureus*), dans 5 % seulement il s'agissait de streptocoques hémolytiques, tandis que dans 10 % on pouvait constater une polyinfection

Dans les panaris *superficiels* le staphylocoque se rencontrait dans 90 % des cas, le streptocoque dans 4 % et la polyinfection

dans environ 6 % Dans les panaris *profonds* la répartition était de 80 % de staphylocoques pour 20 % de streptocoques

Si l'on tient compte de la gravité du processus inflammatoire selon les diverses espèces de microbes il semble que les streptocoques comme tels provoquent des affections plus sévères (la guérison y demande un temps plus long) que les staphylocoques ou les associations microbiennes

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## Zur Kenntnis der Beschwerden seitens des Ureterstumpfs nach Nephrektomie.

Von

EINAR LJUNGGREN

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Wie ich in einer fruheren Arbeit hervorgehoben habe, kann nach Nephrektomie bei einseitiger Nierentuberkulose ein zuruckgelassener tuberkuloser Ureterstumpf dem Patienten Beschwerden verursachen. Ich habe daher die Ansicht ausgesprochen, dass in allen Fallen, in denen eine ausgesprochene Tuberkulose des Harnleiters vorliegt — was sich infolge unserer modernen Röntgentechnik in der Regel vor der Operation feststellen lasst — eine totale Ausrottung des Harnleiters im Zusammenhang mit der Nephrektomie ausgefuhrt werden muss.

Es kommt jedoch auch bei anderen infektiösen Erkrankungen der Nieren und der Harnleiter vor, dass nach einer Nephrektomie Beschwerden auf der operierten Seite fortbestehen, deren Ausgangspunkt der zuruckgelassene Ureterstumpf ist. Derartige Falle sind jedoch ziemlich selten und deshalb in der Literatur weniger beachtet worden, wie man ja uberhaupt dem Schicksal des Ureterstumpfs nach der Nephrektomie weniger Aufmerksamkeit geschenkt hat. Wir haben jedoch einige einschlagige experimentelle Untersuchungen, u. a. von LACHEM. Die Ergebnisse seiner Versuche an Hunden, die an der Mayoschen Klinik ausgefuhrt worden sind, lassen sich kurz folgendermassen zusammenstellen:

1. Im normalen Harnleiter kommt es nach der Nephrektomie lediglich zu einer Atrophie der Muskulatur, wahrend die Schleimhaut und Lichtung erhalten bleiben.

2. Es entwickelt sich bei vollstandiger Verlegung des Harnleiters ein Hydroureter mit Hypertrophie der Muskulatur, zu der im wesentlichen die ringformige Schicht beiträgt.

3 Fließt aus dem hypertrophierten Pyo- oder Hydroureter nach der Nephrektomie der Inhalt ab, so bleibt die Schleimhaut unverändert und die Muskelschicht atrophiert allmählich

4 Bei bestehendem Abflusshindernis bleibt in diesem Fall die Schleimhaut unverändert, desgleichen auch der hypertrophische Zustand der Muskulatur

5 In einem erweiterten Harnleiter wird der Inhalt, wenn überhaupt, nur in ganz geringem Masse resorbiert

6 Ist der Inhalt des Harnleiters infiziert, so kann es zu Entzündungen und Abszessbildungen in der Umgebung des Harnleiters kommen

Bei Infektionen des Nierenbeckens und der Niere kann der Ureter in Mitleidenschaft gezogen werden (Ureteritis evtl. Periureteritis). Auch wenn es im allgemeinen bei geringfügigen entzündlichen Veränderungen nach der Nephrektomie zu Ausheilung der Ureteritis kommt, so ist bei gröberen pathologisch-anatomischen Veränderungen der Ureterwand nicht immer mit einer restlosen Ausheilung zu rechnen. Dies ist besonders der Fall, wenn ein Abflusshindernis im unteren Abschnitt des Harnleiters mit dadurch bedingter Rückstauung der Entzündungsprodukte vorhanden ist. Ein solches Abflusshindernis kann durch eine organische Verengung des Harnleiters (z. B. eine kongenitale Stenose oder entzündlich fibrose Strikturen) verursacht sein, oder es kann sich um einen tiefsitzenden im Ureterstumpf zurückgelassenen Stein, einen papillären Tumor oder eine Kompression von aussen handeln. In den Fällen mit Abflusshindernissen hypertrophiert oft die Muskulatur. Ferner wird sein Lumen häufig erweitert, und es treten Kolikanfälle, Fieber und Pyurie auf, wie haben da das ausgesprochene Bild eines sog. *Stumpfempyems*. Während des Kolikanfalls kann der Harn völlig normal sein, wenn sich aber der Harn spontan einen Ausweg nach der Blase schafft, finden die Beschwerden mit einer plötzlich einsetzenden Pyurie ihren Anschluss (vgl. unten Fall KIDD). In schwereren Fällen verbreitet sich die Infektion durch die Wand des Harnleiters, es tritt eine Periureteritis auf und mitunter können sich Periureteralabszesse bilden. In seltenen Fällen kann die Ligatur am Ureterstumpf abgleiten, und es tritt dann eine Fistelbildung in der Nephrektomiewunde auf.

Wie PERLMANN hervorhebt, kann auch eine Sekretstauung von Entzündungsprodukten entstehen, wenn eine mangelhafte oder gar eine aufgehobene Kontraktilität des Ureterstumpfes vorliegt.

PERLMANN sagt feiner »Eine besondere Stellung unter den Affektionen des Harnleiters nimmt die Ureteratonie ein bei der der Ureter ein schlaffes, erweitertes Rohr darstellt welches in breiter Kommunikation mit dem Blasencavum steht Hierdurch entstehen Wechselbeziehungen, die sich in einem Fortbestehen der Ureter- und Blaseninfektion auswirken, die therapeutisch nur schwer beeinflussbar ist« In einer Arbeit über den Riesenharnleiter betont LEYH daher kurzlich mit Recht »Therapeutisch hat sich in Fällen von einseitiger Erkrankung die operative Entfernung des Riesenharnleiters samt der dazugehörigen, fast immer minderwertigen Niere bestens bewahrt (Nephro-Ureterektomie)«

Die Diagnose einer Ureterstumpfkrankung stützt sich vor allem auf das Ergebnis der Zystoskopie in Verbindung mit der Sondierung des Harnleiters und des Röntgenbildes.

In der Literatur sind eine Reihe Fälle von Stumpfempyem veröffentlicht worden Einige Beispiele mögen folgen

*Fall Endrlin* Nephrektomie wegen Pyonephrose Die Pyurie verschwand nach der Nephrektomie nicht Eine nach 7 Jahren vorgenommene Kontrastemspitzung in den Ureterstumpf zeigte, dass dieser erweitert war Die totale Ureterektomie führte rasch Heilung herbei Kurz vor der Mündung in die Blase konnte eine Verengung des Ureters nachgewiesen werden

*Fall Rodhus* Hier lag ein ähnlicher Zustand vor Die Symptome erstreckten sich über einen Zeitraum von mehr als 17 Jahren In diesem Fall war auch eine oberhalb der Blase gelegene Ureterstriktur vorhanden

*Fall Lower* Ein 48-jähriger Mann, bei dem wegen »calculous pyonephrosis« Nephrektomie und partielle Ureterektomie gemacht wurde Ein Jahr später musste eine Exstirpation des zurückgelassenen Teils des Harnleiters vorgenommen werden, »which completely cured the frequency, dysuria, and kidney sinus wound«

*Fall Hashinger* 54-jährige Frau mit einseitiger Nierenaplasie, die unter dem Bilde einer Pyonephrose operiert worden war Da der Ureter nicht in toto zu exstirpieren war, begnügte man sich mit einer Resektion Ein bald darauf sich entwickelndes Ureterempyem zwang zur totalen Ureterektomie Als Ursache der Erkrankung fand sich eine hochgradige Verengung der Uretermündung

*Fall Kidd* 66-jährige Frau wurde wegen Nephrolithiasis mit Hydro-nephrose und Hydroureter, dieser von der Weite eines Fingers, operiert Eine linksseitige Nephrektomie wurde gemacht und dabei nur der obere Abschnitt des Harnleiters exstirpiert Sie wurde 6 Jahre später untersucht und gab da an, dass sie sich viel besser fühlte, trotzdem traten aber zeitweise links Koliken mit Fieber und Miktionsbeschwerden auf, die mit plötzlich einsetzender Pyurie ihr Ende fanden Darauf pflegte

der Harn monatelang klar zu sein. Bei der Zystoskopie zeigte es sich, dass eine für den Ureterkatheter undurchgängige tiefsitzende Strikture des Harnleiters vorhanden war.

BLUM, BRONGERSMA, CHABANOLLE, CASPER, FOWLER, HYMAN u. a. haben über Fälle berichtet, in denen ein Ureterkonkrement die Entstehung von Ureterstumpfeempyem verursacht hatte.

Von grossem Interesse ist die Erfahrung, dass sich Erscheinungen einer Ureterstumpferkrankung erst nach vielen Jahren bemerkbar machen können. In diesem Zusammenhang sei daran erinnert, dass HYMAN »calls attention to the extreme surgical difficulty in removing these old infected ureteral stumps«.

In den Fällen, wo der Harnleiter nicht verengert ist, kann man mitunter durch palliative Massnahmen die Infektion desselben zum Ausheilen bringen.

KIDD schildert einen derartigen beleuchtenden Fall. Bei einer Frau wurde eine grosse infizierte Hydronephrose exstirpiert. Man fand ein abereierendes Nierengefäss, der Harnleiter unterhalb des Gefässes war nicht erweitert, muss aber infiziert gewesen sein. Die Patientin wurde 4 Monate nach der Operation untersucht. Sie hatte noch immer Schmerzanfälle in der rechten Nierengegend ähnlich denen wie vor der Operation, doch nicht so stark gehabt. Diese Anfälle waren von Strangurie, Pyurie und Fieber begleitet gewesen. Durch Katheterisieren des Harnleiters ergab es sich, dass der rechte Ureterstumpf infiziert, aber nicht verengert war. Die andere Niere war gesund. Der Ureterstumpf wurde mehrere Male mit kolloidaler Silberlösung ausgespült »and the symptoms cleared up completely«.

Ich bin in der Lage, zwei Fälle vorzulegen, bei denen Beschwerden seitens des Ureterstumpfs eingetreten waren. Diese Fälle sind von Interesse besonders auch deshalb, weil die Nephrektomie in beiden Fällen an Patienten, die erst 1 Jahr alt waren, gemacht worden ist.

Fall I. Mädchen, am 1. XII. 1931 geboren.

Die Patientin erkrankte am 7. VI. 1932 mit 40° Fieber und infiziertem Harn (Colibakterien). Die Temperatur sank nach einigen Tagen, bald aber trat ein erneuter Temperaturanstieg ein.

*Aufnahme ins Sachsche Krankenhaus in Stockholm am 2. VIII. 1932.*

Aus dem Status: Blasses, schlaffes Aussehen. Harn: Heller, neg. (mitunter pos.). Im Sediment massenhaft Eiterkörperchen und Colibakterien. Die Temperatur war während des Krankenhausaufenthalts in der Regel afebril, mitunter aber kamen Temperatursteigerungen vor.

Eine Urographie (ÅKERLUND) wurde zweimal gemacht (subcutane Injektion von Perabrodil). Beide Male sieht man ein kontrastgefülltes Nierenbecken von normalem Aussehen und einen normal weiten Harn-

leiter auf der linken Seite, auf der rechten Seite fand sich dagegen keine sichtbare Kontrastausscheidung

Eine *Zystoskopie* (KEY) wurde zweimal, das letzte Mal am 4 I 1933, vorgenommen. Die Blasenschleimhaut war etwas injiziert. Die rechte Harnleitermundung klaffend, die linke normal. Es gelang nur, die linke zu katheterisieren, wobei man normalen Harn von ihr erhielt.

Am 10 I 1933 *Operation* (KEY) in Avertinnarkose, rechtsseitiger Lumbalschnitt. Man fand eine erhebliche Hydronephrose mit fingerweitem gewundenem Harnleiter (Abb 1). Nephrektomie mit Entfernung des obersten Abschnittes des Harnleiters. Die Bauchwunde wurde völlig geschlossen und der Ureterstumpf an die Bauchwunde genäht.

*Mikroskopische Untersuchung* (WAHLGREN). In den untersuchten Teilen der Niere sind die meisten Glomeruli hyalinisiert oder im Unter gang begriffen, ihre Kapseln verdickt und hyalinisiert. Nur vereinzelte unveränderte Glomeruli sind noch vorhanden. Die Nierenkanäle der Rinde sind auch zum grossten Teil zerstört. Das interstitielle Bindegewebe ist in der Rinde sowie in Mark erheblich reichlicher als im allgemeinen und von entzündlichen Zellen zumeist Lymphozyten durchsetzt. Die geraden Kanäle des Marks kommen in geringer Anzahl vor und sind weit, ihr Lumen häufig mit Leukozyten angefüllt. Die Wand des Nierenbeckens ist reichlich mit Lymphozyten durchsetzt. Keine Gefässveränderungen in der Niere. *Path-anat Diagnose*: Chronische Pyonephrose mit Schrumpfung (pyogene Schrumpfniere).

KEY hat folgende Epikrise über diesen Fall geschrieben. Durch Exstirpation der infizierten, hydronephrotischen Niere ist die Ursache der Pyelitisanfälle mit den hohen Temperatursteigerungen beseitigt. *So lange bei der Patientin der unterste Abschnitt des rechten Harnleiters noch da ist, ist wohl nicht zu erwarten, dass ihr Harn bakterienfrei wird.* Es erschien mir bei der Operation jedoch ein zu grosser Eingriff bei dem kleinen Kind, den ganzen Harnleiter zu exstirpieren. Ich hoffe, dass sich die Patientin jetzt nach Entfernung der Niere normal entwickeln wird, und dass man sie späterhin unter günstigeren Bedingungen erneut operieren und den zurückgelassenen Teil des rechten Harnleiters exstirpieren kann, um dann, wenn möglich ihren Harn bakterienfrei zu bekommen.

Die Patientin wurde am 26 I 1933 per primam geheilt aus dem Krankenhaus entlassen. Der Harn enthielt jedoch noch immer ungefähr ebenso viel Eiter wie vor der Operation.

Die erste Zeit, nachdem sie nach Hause gekommen war, war sie frisch und munter, hatte normale Temperatur und erholte sich gut.

Im August 1933 trat eine etwa 10-tägige Fieberperiode (38°—39°) ein. Die Patientin hatte auch Schnupfen und litt an Erbrechen. Später im September, November und Dezember 1933 ähnliche Krankheitsperioden mit Fieber. Sie lag den ganzen Februar 1934 mit Fieber von etwa 38°, aber ohne Anzeichen von Erkältung zu Bett. Später erneute Fieberperioden, dazwischen mehrere Monate, wo sie gesund und munter zu sein schien und guten Appetit hatte, es trat dann eine neue Fieberperiode ein, als man es am wenigsten gehäht hatte. Der Harn hat immer Eiter enthalten, doch weniger als vor der Operation.



Abb 1 Fall 1 Der pyonephrotische Niere mit dem dilatierten Ureter



Abb 2 Fall 1 Der dilatierter kontrastgefüllte Harnleiterstumpf  
4 1/2 Jahre nach der Nephrektomie

LJUNGGREN Beschwerden seitens des Ureterstumpfs nach Nephrektomie





*Erste Aufnahme ins Sachssche Krankenhaus am 14 V 1934*

Am 22 V 1934 *Zystographie* in Avertinnarkose mit Abrodillosung (KNUTSSON) Der Blasenschatten etwa mandarinengross Auf einer der Aufnahmen sah man einen *Reflux im linken Harnleiter*, dieser war erweitert Im rechten Ureterstumpf fand sich dagegen kein Reflux

Der Harn enthielt im allgemeinen — jedoch nicht immer — Eiweiss Im Sediment eine mehr oder weniger grosse Anzahl Eiterkörperchen und Colibakterien Behandlung mit Vaccin Die Patientin im allgemeinen fieberfrei, aber einige Male Temperatursteigerungen bis zu 39° Die Pat wog bei der Entlassung am 6 VI 1934 12,940 gm, sie war da etwa 2½ Jahre alt

Danach ziemlich gesund, obgleich der Harn stets Eiter und Bakterien enthalten hatte Im Frühling 1937 Grippe Nachher war der Harn ziemlich klar Am 14 VIII 1937 erkrankte sie akut mit Frosteln und hohem Fieber, der Harn sehr trube Sie lag einige Zeit mit hohem Fieber zu Hause

*Aufnahme ins Krankenhaus in Solleftea am 30 VIII 1937* Die Pat war da 6 Jahre und 9 Monate alt

Der Harn leicht getruibt Heller schwach pos Sed reichlich Eiterkörperchen und Colibakterien Rest N 45 mg %

*Röntgenuntersuchung* Eine Übersichtsaufnahme der Harnwege zeigt auf der linken Seite einen für das Alter der Patientin auffallend grossen Nierenschatten

*Urographie mit Perabiodil* (ENGBERG) Drei Minuten nach der Injektion wird keine Kontrastausscheidung beobachtet, was zeigt, dass sie verspatet ist Nach 10 Minuten sieht man eine deutliche Kontrastfüllung des linken Nierenbeckens Die Kontrastsättigung ist auffallend gering Nach Anlegen einer Kompression erhält man keine grossere Kontrastsättigung, so dass sich die Konturen des Nierenbeckens nicht überall deutlich begrenzen lassen Die Kelche scheinen etwas gross zu sein, aber kaum grosser als es die Grosse der Niere erfordert Das anatomische Nierenbecken ist auch deutlich vergrössert, wenn auch nicht in so hohem Grad, dass man von einer eigentlichen Hydronephrose sprechen konnte

*Zystographie* Die Blase von normaler Form und Konfiguration, in keinem der Harnleiter ein Reflux

*Zystoskopie* (LJUNGGREN) Die Blasenschleimhaut sieht ziemlich normal aus Die linke Uretermündung leicht gerötet, sonst normal Die rechte Uretermündung klaffend Beide Seiten wurden katheterisiert Der Harn vom linken Harnleiter war klar, aber im Sediment fanden sich Leukozyten und Colibakterien Cystochrom wurde eingespritzt, es dauerte etwa 8 Minuten, bis blaugefarbter Harn aus dem linken Harnleiter herausfloss

In den rechten Harnleiter wurde Kontrastflüssigkeit eingespritzt Die Röntgenaufnahme (Abb 2) zeigte, dass der Ureterstumpf war erweitert, etwa von der Weite eines kleinen Fingers, verschmälert sich aber trichterförmig im untersten Abschnitt (eine Verengerung des Ureters gleich oberhalb der Uretermündung?) Da die linke Niere jetzt auch infiziert und ihre Funktion herabgesetzt war, wollte man nicht

dazu raten, den Ureterstumpf auf der rechten Seite zu exstirpieren. Die Veränderungen in der linken Niere waren aller Wahrscheinlichkeit nach so weit fortgeschritten, dass mit ihrer Ausheilung nicht zu rechnen war, im übrigen hatte die Patientin diesen Eingriff wahrscheinlich nicht überstanden.

Die Patientin wurde am 6. X. 1937 entlassen.

Sie starb im Jahr 1940 an Uramie.

Fall 2. Mädchen, am 2. VI. 1934 geboren. Aufnahme in die chirurgische Abteilung des Kronprinzessin Louise Krankenhauses am 17. VI. 1935. Im Januar 1935 ein paar Tage hohes Fieber, Eiter im Harn wurde konstatiert. Der Harn ist seitdem stark getrübt gewesen. Die Temperatur hat zwischen  $37,3^{\circ}$ — $37,6^{\circ}$  gelegen. Den letzten Monat keine Gewichtszunahme. Wurde lange mit Antiseptika für die Harnwege behandelt.

Die Temperatur etwa  $38^{\circ}$ . Der Harn stark getrübt, im Sediment reichlich Eiterkörperchen (Colibakterien und auch grampositive Kokken).

Am 17. VI. *Subkutane Urographie* (20 cm 7,5 prozentige Perabrodilösung). Rechterseits ein erweitertes Nierenbecken, zum wenigsten ist der obere Abschnitt des Harnleiters erweitert.

Die *retrograde Pyelographie* zeigte, dass eine erhebliche Erweiterung des ganzen rechten Harnleiters vorlag. Die Erweiterung war unmittelbar oberhalb der Blase besonders stark. Das linke Nierenbecken und der Harnleiter waren normal.

Am 22. VI. *Nephrectomia dextra* (PERMAN). Der Harnleiter war in seiner ganzen Länge erheblich erweitert, er wurde ungefähr bei der *Linea terminalis* geteilt.

Die exstirpierte Niere hatte ein erweitertes Nierenbecken. Die Kelche waren erweitert und gingen breit in das Nierenbecken über, der Harnleiter war erheblich erweitert.

Bei der Entlassung am 7. VII. war der Harn noch immer trübe und enthielt Eiter und Bakterien.

Trotz langer weiterer Behandlung verschwand die Infektion nicht. Im Juni 1936 ging ein kleines Konkrement ab. Eine Röntgenuntersuchung zeigte ein paar Konkremente rechterseits im kleinen Becken. Beim Zystogramm füllte sich der zurückgelassene Ureterstumpf auf der rechten Seite. Er war stark erweitert und mehrere Konkremente lagen in ihm. Erneute Aufnahme. *Operation* (PERMAN). Die Blase wurde durch einen medianen Schnitt oberhalb der Symphyse freigelegt. Der Ureterstumpf wurde isoliert und exstirpiert. In ihm fanden sich Konkremente.

Nach dieser Operation verschwand die Infektion der Harnwege rasch. Die Patientin ist seitdem völlig gesund.

In diesen beiden Fällen sind die Patienten im Alter von 1 Jahr wegen infizierter Hydroureter mit Hydroureter operiert worden. Es wurde eine Nephrektomie und die Exstirpation des obersten Abschnitts des Harnleiters gemacht. In beiden Fällen war

der Harn nach der Operation nicht bakterienfrei. Im ersten Fall trat zeitweise Fieber ein, was anfangs wahrscheinlich durch den im Ureterstumpf zurückgebliebenen Eiter verursacht wurde (möglicherweise lag eine Verengung seines unteren Abschnittes vor). Allmählich wurde auch die zurückgebliebene Niere infiziert. Die Patientin starb 7 Jahre nach der Operation an Uramie. Im zweiten Fall trat eine Konkrementbildung im Ureterstumpf auf (ein vesico-ureteraler Reflux lag vor). Ein Jahr nach der Nephrektomie wurde der Ureterstumpf exstirpiert, wonach die Patientin bakterienfrei war.

Um die Entstehung von Beschwerden seitens des Ureterstumpfes nach der Nephrektomie zu vermeiden, ist es notwendig, dass, wie KIDD betont »Painstaking attention should be paid to the condition of the ureter before embarking on nephrectomy, as in selected cases the removal of the major, or the whole, portion of the ureter in addition to the kidney will be found to give very much better after-results than mere nephrectomy alone.« Bei Fällen von einseitigen infizierten Hydroureteren mit Abflusshindernissen in dem untersten Abschnitt des Harnleiters oder bei Fällen, wo ein vesico-ureteraler Reflux besteht, muss also gleichzeitig mit der Nephrektomie eine totale Ausrottung des Ureters vorgenommen werden. Ist das Allgemeinbefinden des Patienten herabgesetzt, können diese Eingriffe eventuell in zwei Sitzungen vorgenommen werden.

### Zusammenfassung.

Verf. berichtet über 2 Fälle, in denen die Patienten im Alter von 1 Jahr wegen einseitiger infizierter Hydronephrose mit Hydroureter operiert worden sind. Nephrektomie und Exstirpation des obersten Abschnittes des Harnleiters wurden vorgenommen. Der Harn war nach der Operation nicht bakterienfrei. In dem einen Fall wurde der erweiterte, infizierte Ureterstumpf nicht exstirpiert, die zurückgelassene Niere wurde später auch infiziert, und diese Patientin starb nach 8 Jahren an Uramie. Im anderen Fall trat eine Konkrementbildung im Ureterstumpf auf, dieser wurde nach 1 Jahr exstirpiert, und die Patientin war dann völlig wiederhergestellt.

### Summary.

Two cases are described in which the patients, at the age of one year, were operated upon for unilateral infected hydro-nephrosis with hydro-ureter. The operations consisted of nephrectomy and extirpation of the upper part of the ureter. The urine was not free from bacteria after the operation. In one case the dilated and infected stump of the ureter was not removed, the remaining kidney later became infected, and the patient died eight years later of uremia. In the other case concretions appeared in the stump of the ureter. The stump was extirpated and the patient recovered completely.

### Résumé.

L'auteur relate le cas de deux malades opérés, à l'âge d'une année, d'hydronéphrose unilatérale infectée avec hydrouretere. On pratiqua une néphrectomie accompagnée de l'ablation de la partie supérieure de l'uretère. L'urine ne devint pas amicrobienne après l'intervention. Dans l'un des cas on omit d'extirper le moignon urétéral dilaté et infecté, le rein restant s'infecta à son tour, et ce malade mourut d'urémie au bout de 8 ans. Dans l'autre, il se forma des concrétions dans le moignon urétéral, celui-ci fut éradiqué après une année, et le malade se rétablit complètement.

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From the Surgical Department of St Goran's Hospital, Stockholm  
(Prof TROELL)

## The Treatment of Hydronephrosis by Means of Cutting and Re-Implantation of the Ureter in the Bladder and the Renal Pelvis, Respectively.

By

ABRAHAM TROELL and OLOF ODÉN

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As a matter of course, the result of the conservative surgical treatment of hydronephrosis depends to a considerable extent on the cause of hydronephrosis in the individual case. As regards the latter factor, particular attention has, for some decades, been paid in Sweden to the assumed importance of the accessory, abnormal renal vessels, as suggested by EKEHORN. However, we are unaware — as far as we know — of the existence of any data concerning the results arrived at in series, whether big or small, of cases, subjected to surgical division of the above-mentioned vessels. In our opinion, vascular anomalies of this kind, of a real significance with regard to the genesis of hydronephrosis, are by no means usual. Thus, during the period of somewhat more than thirteen years in which the Surgical Department of St Goran's Hospital has existed, only 5 of the 38 cases of hydronephrosis, submitted to surgical intervention, disclosed accessory renal vessels. Moreover, at operation, only 2 of these 5 cases displayed a topography of the renal vessels and the ureter, indicative of a more or less probable genetic significance of the vessels with regard to the hydronephrosis.

*One of the two cases (1925/1940) concerned a maidservant, 20 years of age, who had been suffering for several years from urinary troubles. Urography revealed signs of right-sided ureteral stenosis with dilatation of the right renal pelvis. Retrograde pyelography disclosed a*

strong bend in the ureter just outside the ureteropelvic junction (N WESTERMARK) According to the operation report (TROELL), the ureter described a sharp curve a little above the lower renal pole, from where, after having been narrow at the distal part, it passed over into the strongly dilated renal pelvis At the curve, the ureter was crossed by an artery, more than twice the thickness of a match, which ran crosswise behind the ureter and continued obliquely upwards and forwards to the anterior part of the renal pelvis After having cut through some adhesions between the two shanks of the concave part of the renal pelvis, and divided the artery between two ligatures, the ureter was seen to straighten in the sharp bend (The significance of adhesions, causing fixation of the ureter to the renal pelvis, has been particularly emphasized by ÖSTLING in "The genesis of hydronephrosis, etc", in Acta chir Scand 86, suppl 72, 1942) The after-course was free from complications Urography, performed two weeks later, showed a picture identical with the one taken before the operation (WESTERMARK)

*The second case* (2118, 2236/1940) concerned a man, 26 years old, whose considerably enlarged kidney — weight 500 grams — had to be extirpated (TROELL) The operation report gives the following description of the specimen Close to the inferior part of the considerable extra-renal dilatation of the pelvis, an artery, a little thicker than a match and a somewhat wider vein ran crosswise, on a level with the kink at which the renal pelvis passed over into the narrow ureter In this connection, a fact of particular interest was illustrated by means of the preoperative retrograde pyelography, viz, the right ureter had a slate-white, even lumen all the way up to the ureteropelvic outlet The obstruction to the evacuation of the renal pelvis was believed to take place, apparently, on the very boundary between the renal pelvis and the ureter Since no concrement was found, nor likely to exist, a kink formation with valvular effect or, possibly, an accessory renal vessel was assumed to have occurred (G FORSSMAN)

It is not the purpose here to enter further upon the question of the above-mentioned hypothesis, concerning the part played by abnormal renal vessels in the genesis and development of hydronephrosis Nor will any attention be directed in this connection to the possible effect, in the long run, of ligation and division of these vessels on hydronephrosis Instead, an account will be given of the result in two cases of ureteral implantation in the urinary bladder and the dilated renal pelvis, respectively, subjected to control close on ten years after the operation

*Case no 1080, 2417/1934* A female hospital servant, 26 years old, was treated at St Goran's Hospital on May 7th—29th, and during October 22nd 1934—January 30th, 1935, with a diagnosis of *hydronephrosis ren sup et hydroureter* dx + cystopyelit subchron (pelvis

renal duplex dx et ureter duplex dx ) The patient had been treated for hyperacidity at the medical department in July 1931 In July, 1932, she was treated for anemia and neurosis, and, in November, 1933, for myalgia dorsi et neurasthenia In January, 1934, she was able to return to work But, in March, 1934, the pains were again felt mostly to the right in the lumbar region No urinary troubles whatsoever No blood in the urine which, nevertheless, had a bad smell and contained bacteria *Stat praes (May 7th, 1934)* Rather pale and fat Tenderness, but no resistance in the depth of the right renal region With the exception of the urinary tracts, nothing noteworthy was found in the internal organs *Cystoscopy (May 11th)* The bladder contained 200 cc The bottom of the bladder slightly injected The left ureteral orifice was somewhat reddened, easily catheterized *The right ureteral torus bulged forwards in the bladder like a peg* The ureteral orifice was situated in the superior region and not at the tip of the torus The urine from both the ureters came at a normal drop tempo The bladder urine was neutral. Traces of alb. Sediment 1—2 fresh, red blood cells and 1—2 white ones per field of vision Abundance of Gram positive rods *The urine of the left ureter* alk, alb, 6—7 fresh, red blood cells per field of vision in the sediment, no bacteria *The urine of the right ureter* was sour, traces of alb Isolated, fresh, red blood cells Very sparse amount of Gram positive rods *Retrograde pyelography* The left renal shadow revealed normal shape and size Also the renal pelvis was normal The upper pole of the right renal shadow was easily distinguished, being observed at the inferior edge of costa XI A comparatively small renal pelvis was filled by means of an inserted ureteral catheter It was situated within the lower part of the observed renal shadow (no calices were seen within the upper half of the kidney) The occurrence of duplicated renal pelves was probable on the right side, only the inferior one, accordingly, having been filled on this occasion Additional finding small calcified glandular shadows in the abdomen (FORSSMAN) *Intravenous urography (May 14th, 1934)* (fig 1) Normal renal pelvis on the left On the right side, two renal pelves and two ureters were filled The superior renal pelvis had a clumsy and dilated appearance Its ureter measured the width of two fingers (WESTERMARK) On May 29th, the patient was discharged for polyclinical treatment After her discharge, she felt almost continuous pains in her right renal region, but she had no urinary troubles On October 20th she fell ill, at half past twelve in the night, with moderate pains in the lower part of the epigastrium Simultaneously, she had fits of vomiting, during which the pains subsided No chills or urinary troubles Watery excrements General condition at admission to the hospital on October 21st, 1934 somewhat affected Halo round the eyes The heart and lungs normal Blood pressure 110/80 Abdomen soft all over Tender in the epigastrium The liver and the spleen not palpable Tapped urinary test gave a sour reaction, no alb Isolated, white blood cells in the sediment, and a comparative abundance of Gram negative rods *Cystoscopy (October 22nd)* Two ureteral orifices on the right Round the medial one a bladder-like expansion occurred



(ureterocele) Traces of alb in the urine of the medial, right ureter 1—3 red blood cells per field of vision in the sediment, sparse amount of white, and epithelial cells Masses of Gram negative rods Alb in the urine of this ureter 5—7 red blood cells per field of vision in the sediment, isolated, white cells and epithelial ones, a sparse amount of Gram negative rods In the urine of the left ureter, a sparse amount of white blood cells, isolated red cells and epithelial ones, and a fairly great quantity of Gram negative rods *Retrograde pyelography* (October 23rd, 1934) The same picture as at the examination on May 11th

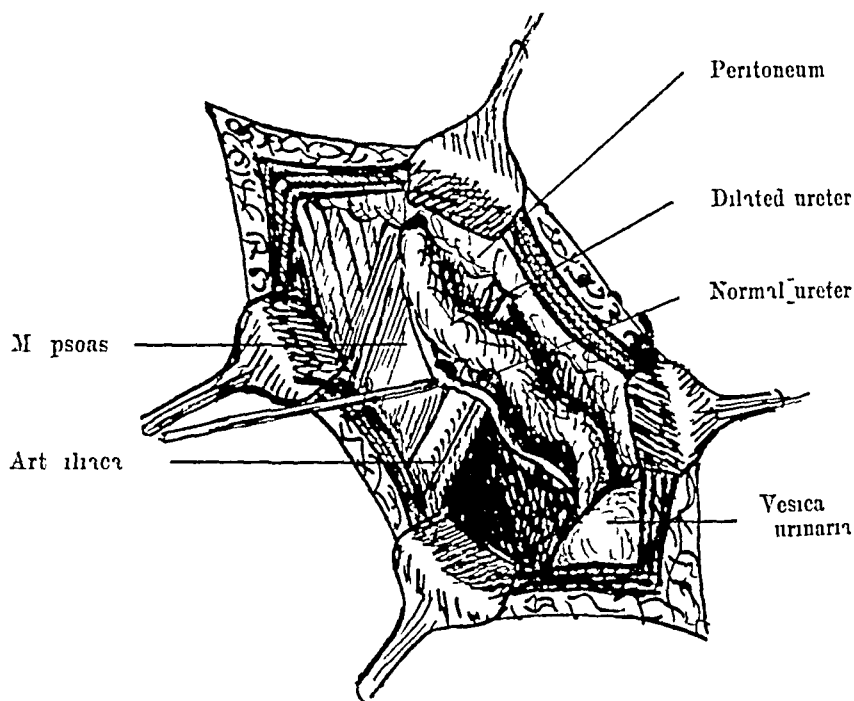


Fig 2

*Urography with intion* (October 25th) The left renal pelvis was filled in the normal way Duplicated right renal pelvis with double ureters The upper one was dilated, with a considerably widened ureter (ULF-SPARRE) *Water test* (October 27th) Evacuation 1,085 cc in 4 hrs, dilution to 1,003, concentration to 1,017 Rest-N 29 % Blood pressure 110/80 Max temp 38° Camphohexine, colitique

*Operation* (October 31st, 1934) (TROELL), with a diagnosis of duplicated renal pelvis and duplicated ureter on the right side + hydro-ureter and hydronephros dx (stenos orifici inferior ureter dx + ureterocele) *Cutting the ureter and re-implantation in the bladder* Lumbar anaesthesia (13 cc percain between LI and LII Excellent effect) With the patient's longitudinal axis rotated a little to the left, an oblique incision was made, parallel to ligamentum inguinale dx, beginning approximately 1 dm laterally and above spina iliaca ant



Fig 1



Fig 5

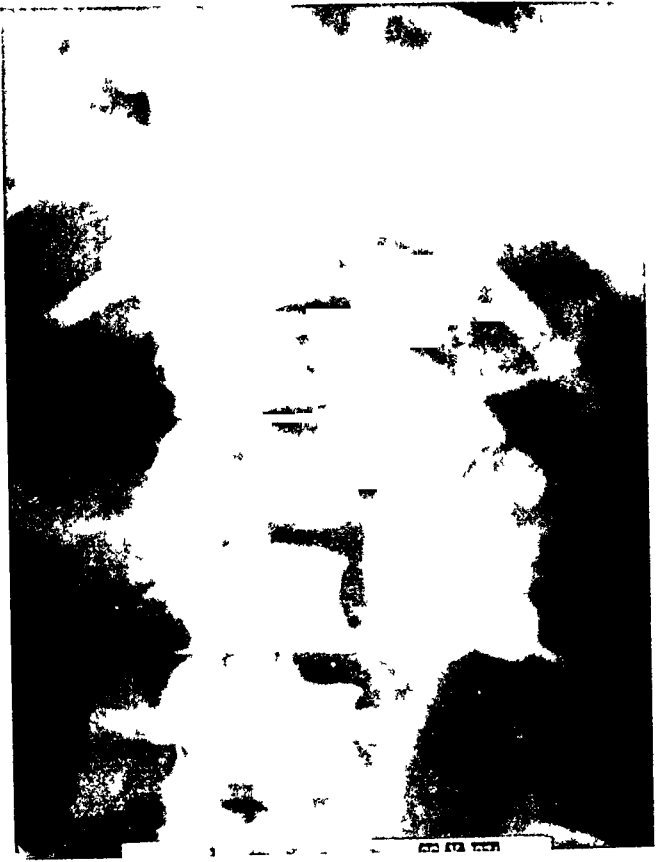
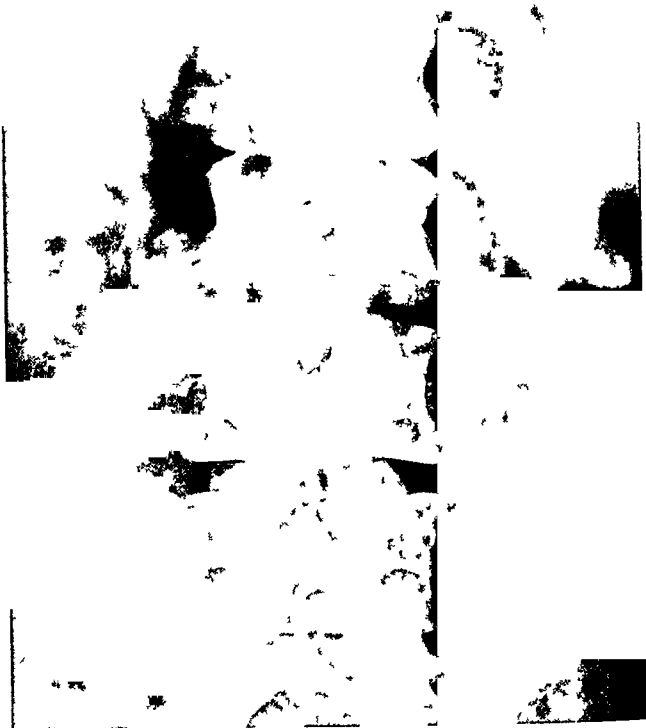
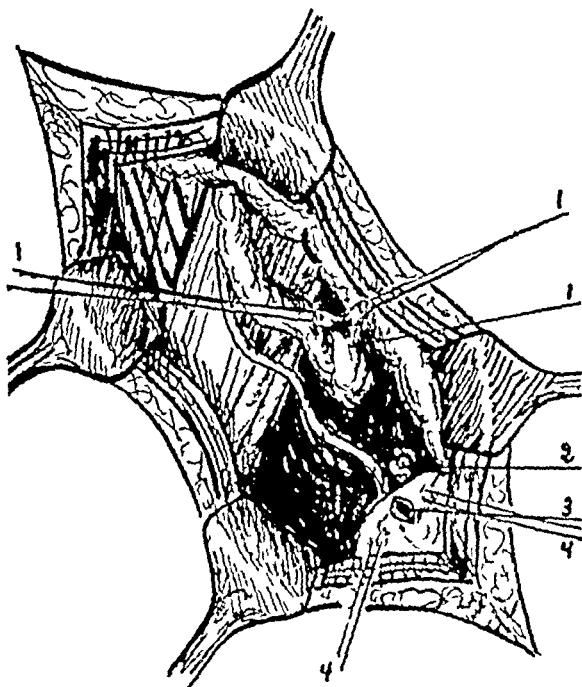


Fig 7



sup The incision continued down to tuberculum pubicum The aponeurosis and the abdominal muscles were cut through in the same direction In this way, a retroperitoneal course was obtained, and the peritoneum could be pushed medially and upwards The ureters, which were easily found bare in the ureteral part of the psoas region and at the inlet to the pelvis minor The wide ureter was situated nearest to the surface It made pronounced contractions during which



1 Proximal end of the dilated ureter split and with sutures for fixation in the bladder — 2 Distal stump of the ureter, invaginated — 3 Urinary bladder, opened — 4 Sutures for fixation in the bladder

Fig 3

t varied in width (fig 2) When in a relaxed condition, its dimensions were the size of the tip of a thumb Later, in order to facilitate reaching the bladder, air was inflated by means of a urethral catheter During this process, air was noticed being pressed out into the wide ureter The narrow ureter had approximately the size of a goose quill Partly by means of blunt, partly by instrumental dissection, the wide ureter was disengaged from its surrounding connections as far as possible down into the pelvis minor (approximately 3 cm, then remaining to the bladder) Here, the ureter was divided after embedding The distal stump was closed by a line of catgut sutures, and, above that, continuous lines of silk and catgut, respectively, were applied Then, a part of the bottom of the bladder was disengaged The bladder was again filled with air, by means of the inserted urethral catheter, and a small incision was made through all the layers The proximal end of the severed ureter was then cut open (fig. 3) so as to form two longitudinal

lips They were sewn fast, each to its own side of the wall of the bladder, with a catgut mattress suture in each of them The stump was lowered into the bladder The external layers of the wall of the bladder was invaginated by means of suturing, the ureteral wall and the spot of the invagination being caught together (fig 4) Connective tissue was sewn round the ureter by means of another line of catgut suture Two cigarette drainings Catgut suture in the muscles and the aponeurosis of the abdominal wall Silk suture in the skin Catheter à demeure On one or two occasions during the operation, a small quantity of urine escaped out into the wound from the severed ureteral ends

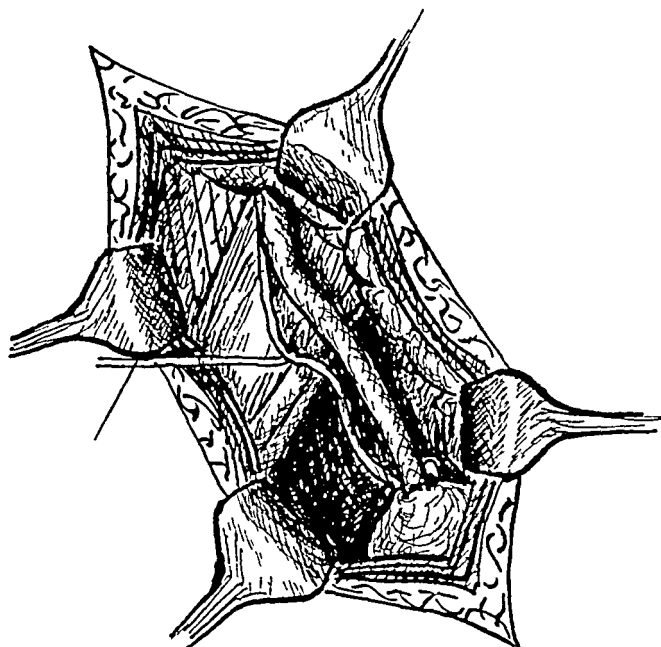


Fig 4

During November and December, tapped ureteral and urinary tests invariably revealed Heller +, a sparse amount of white blood cells, Gram negative rods and Gram positive cocci in bunches *Urography* with uroselectan B (December 20th, 1934) The left renal pelvis was well filled The right one filled less well and was divided into two, as at earlier examinations The superior one of them was still somewhat dilated, as was, also, the ureter (ULFSPARRE) *Cystoscopy* (January 3rd, 1935) On the right side, no access to the new ureteral orifice was well obtainable On the other hand, the old orifice could be entered only for a stretch of one or two cm When the catheter was withdrawn, some pus appeared Urine was obtained from the catheter in the left ureter As before, the bladder urine in January gave alb and bacteria *Cystoscopy* (January 15th, and 18th) A large bulge was now visible on the spot of the old ureteral stump On two occasions, attempts were made to burn a hole here in order to drain away the pus which, un-

doubtedly, occurred. At the last attempt, the bulge seemed to become less tense. Bladder urine as before. *Cystoscopy* (January 26th). The old ureteral orifice was successfully sounded up to catheter no 12. Suppuration from it continued. The patient was discharged on January 30th.

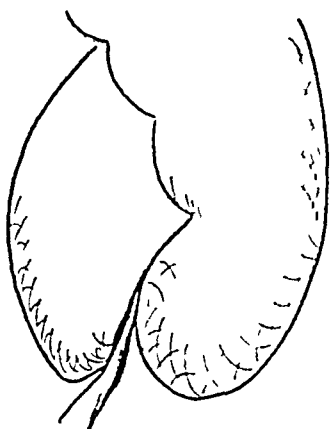
*Urography* with uroselectan B (January 15th, 1936) showed distinct renal shadows. The left renal pelvis filled completely. The right renal pelvis was duplicated and presented the same pictures as before (ULF-SPARRE). *Retrograde pyelography* (August 1937, January 1938, October 1938, and February 1940). The lower, right renal pelvis was filled. No catheter could be inserted into the upper one.

*Urography* (September 18th, 1943). The renal shadows of normal shape and size. The left kidney showed normal excretion and normal shape. The right kidney emptied at a somewhat slower pace. Gradually, both of its renal pelvises were filled. The upper renal pelvis was a little dilated, but not to the extent of earlier examinations. The lower renal pelvis appeared as before (WESTERMARK). The patient felt very well. The urine was sour and free from alb. It contained a moderate amount of white blood cells and rather an abundance of rods.

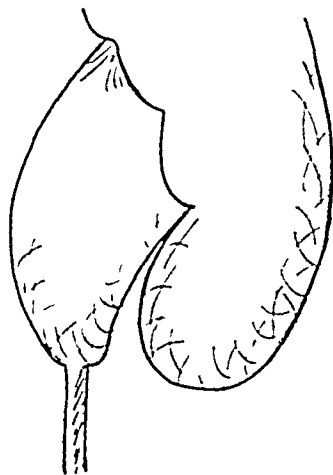
*Case no 2268, 2812/1934*. A female bath attendant, 43 years old, treated at St Goran's Hospital during October 3rd—31st and December 3rd—5th, 1934, with a diagnosis of *hydronephrosis ren dx*. The patient was entered at the hospital as an acute abdominal case. She fell ill on September 28th, with pains on the right side of her back, radiating forwards. Frequent desire to urinate on October 1st. Never blood in the urine. Chills on October 1st and 2nd, with a temperature up to 40°. The pains disappeared on October 2nd, but, ever since, the patient felt a stitch in her back. Menses regular, always painful, the last time a fortnight ago. Sluggish evacuation. *Status praes.* General condition good. No pains. Temp 38.2°. The heart and lungs without remark. The abdomen soft and tender, no palpable resistances. No tenderness over the right kidney. The urine clear, sour. Heller faintly positive, 3—5 red blood cells in the sediment per field of vision, sparse amount of white blood cells, no bacteria. *Cystoscopy* (October 5th). The bladder held 200 cc. Slight redness of the trigone. Small fibrinous flocks on the bottom of the bladder. Ureteral orifices without remark. A catheter was easily inserted on both sides. Slightly clouded urine, ejected bilaterally at a light drop tempo. An abundance of white blood cells, isolated red ones, and a rather big amount of Gram negative rods were found in the bladder urine and in the right ureteral urine. In the urine from the left ureter, one or two isolated white blood cells were ascertained, no bacteria. Röntgen examination. Both the renal shadows were clearly visible and had identical shape and size. The distance between the upper and the lower kidney poles measured 15 cm. At *retrograde pyelography* (uroselectan B) the left renal pelvis was noted to be well filled with contrast medium and of normal shape and size. The right renal pelvis was enormously dilated. Kink formation (fig 5) at the ureteropelvic outlet (FÖRSSMAN). *Water test* (October

Sth) Excretion 810 cc in 1 hrs, dilution to 1,002, concentration to 1,019 Rest-N 40 mgr %

*Operation* (October 10th) with a diagnosis of infected right-sided hydro-nephrosis (TROILL) *Division of the ureter and implantation of the distal ureteral stump into the renal pelvis* Lumbar anaesthesia (15 cc percam between L1—LII, excellent effect) A large, arched renal incision The kidney was easily detached It appeared to be of normal size No peri-nephritis The renal pelvis was at least the size of a hen's egg, and tense Its inferior pole was freed by blunt dissection Thus, it could be lifted upwards and laterally In this connection *no accessory vessels* were found On the other hand, it was quite evident that the ureter, with its very narrow upper portion (just below, the ureter again widened), opened out



Before operation



After operation

Fig 6

at a very acute angle a few cm up the medial and posterior side of the renal pelvis (fig 6) Therefore, this fact, as well as, perhaps, the narrowness may, probably, have caused the insufficient capacity of the ureter to drain the renal pelvis The ureter was cut through at its highest point The uppermost mm were resected for microscopical examination Two lips were formed by two small longitudinal cuts in the end of the ureter By means of a suture in each lip, the ureteral stump was drawn into an incision, hardly 1 cm wide, in the lower pole of the renal pelvis Each lip was fixed with a silk mattress suture in the respective walls of the renal pelvis (fig 6) Then a ureteral catheter was pushed 30 cm down into the bladder The upper end of the catheter was let down into the renal pelvis The latter was closed with two invaginating silk sutures, one line also including the ureter A couple of flaps of the fat capsula were sewn fast with catgut round the site of the implantation Cigarette drainage, behind and below the implantation point Otherwise suture in the usual manner

*Cystoscopy* (October 13th) The bladder held 200 cc The inserted ureteral catheter was situated with its lower end in the bladder and

was removed rather easily by operation cystoscope (ODEN) On October 17th, the urine was sour, no alb, but rather a great amount of Gram negative rods and white blood cells The after-course uneventful *Cystoscopy* (October 26th) The mucosa of the bladder somewhat reddened in the trigone The ureteral orifices without remark The urine was ejected rhythmically in a drop tempo from the right side It was very cloudy, contained alb, masses of white blood cells, isolated red ones, and one or two Gram negative rods The urine from the left ureter was without remark *Retrograde pyelography* The right renal pelvis was dilated, as before the operation After the withdrawal of the ureteral catheter, the renal pelvis slowly drained On October 29th, the urine was sour, free from alb Rather a great quantity of white blood cells, isolated red ones, no bacteria

*Pathological-anatomical diagnosis* of the ureteral fragment A pronounced edema was noticed within the examined parts of the ureter, and, in the submucosa, an abundant infiltration of inflammatory cells occurred The epithelium revealed no noteworthy changes The muscular layers were only partly included in the specimen Accordingly, sub-acute pyelitis Growth of coli bacilli (WAHLGREN) *Urography* with intron on October 30th (ULFSPARRE) The left renal pelvis with calices filled in the normal way The right one filled at a slower pace, was strongly dilated, and had clumsy, distended calices (fig 7) On December 4th, 1934, urinary findings and *retrograde pyelography* as before Contrast medium was observed to remain even 6 hours after the administration of uroselectan B (SCHACHTEL) The patient was free from troubles *Retrograde pyelography* on February 14th, 1935, disclosed a decrease in the size of the right renal pelvis On October 12th, in the same year, the patient was fit for work and free from symptoms The urine without remark

On September 18th, 1943, her condition was found to be excellent Normal urine *Urography* (WESTERMARK) disclosed renal shadows of normal shape and size Normal and simultaneous excretion from both the kidneys The left renal pelvis was of normal size The right one was somewhat dilated, but not to the extent found at earlier examinations (fig 8)

Reference is here made to two cases of hydronephrosis in female patients, in which the troubles involved in this malformation were neutralized by means of cutting the ureter, belonging to the hydronephrosis sac, and implantation of the same in the urinary bladder and the renal pelvis, respectively

The first patient had felt symptoms for about 6 months To begin with, they were interpreted as muscular pains in the back and neuroasthenia However, during the last two months prior to admission to the surgical department, they more plainly originated in a right-sided renal trouble of some kind At the hospital, normal conditions were ascertained as regards the left



kidney, but infected urine was found in the right kidney and urinary bladder. Five months after the first examination, the troubles had increased considerably, in spite of conservative treatment (urinary tract antiseptics, etc). Now, also the left kidney had infected urine. On the right side, an inferior renal pelvis was found, of normal size and with slightly infected urine, as well as a superior, clumsy and dilated renal pelvis with an abundance of bacilli in the urine (fig 1). From the latter renal pelvis a greatly dilated ureter proceeded right down to the urinary bladder, terminating in the bladder laterally of the ureter from the inferior pelvis. It had the appearance of a ureterocele in the cystoscopic picture. A *congenital malformation*, accordingly, formed the anatomical basis of the hydronephrosis and the hydroureter. Operation by the *division of the ureter at its lowest end and implantation of its proximal ends in the bladder* proved successful (figs 2—4). The healing proceeded without complication. At the after-examination, 9 years later, the patient was altogether fit for work and had no urinary troubles (she had not been aware of the infection in the urine which was still ascertainable). Urography disclosed the fact that *the former occurrence of a dilatation of one of the renal pelvis had been clearly reduced*.

The *second* patient was admitted to the hospital as an acute abdominal case. She had no earlier troubles to relate. However, she had now been suffering, for five days, from pains in the right renal region and also, for two days, from urinary frequency. Chills and a high temperature had followed. The left kidney excreted normal urine, but the right one discharged a strongly infected urine. A complete examination revealed a considerable right-sided hydronephrosis and a kink formation in the ureter at the ureteropelvic outlet (figs 5—7). The operation performed shortly afterwards gave no explanation of these anatomical conditions (no accessory vessels, etc). It revealed the superior part of the ureter to be very narrow, the ureter opened out at a very acute angle a couple of cm up the posterior, medial wall of the renal pelvis (fig 6). The intervention was performed in the following way. *The ureter was divided at its highest point. Then, its distal section surface was implanted into the inferior pole of the renal pelvis* (fig 6). A ureteral catheter which had been inserted down into the bladder from the renal pelvis was removed with the help of an operation cystoscope after three days. Uneventful healing. An after-examination, 9 years later, disclosed, also in

this case, a quite satisfactory development The patient was fit for work and felt very well No infection remained in the urine. Urography disclosed a reduction in size of *the formerly strongly dilated renal pelvis* (fig 8)

The two cases are of hardly more than documentary interest. Complete anatomical restitution of pronounced hydronephrosis is, to judge from this experience, not to be expected, even after a very long time This also applies to cases in which surgical intervention successfully eliminate an obstruction in the way of the emptying the renal pelvis, thus, making the patient clinically free from symptoms and quite fit for work As regards the technique of the surgical treatment the advantage of, in principle, similar methods in both the cases for re-establishing good passage for the urine through the ureter deserves to be emphasized the severed end of the ureter was cut open longitudinally, so that the stump formed two lips These lips then were sewn in, each in its own direction, in the bladder and the wall of the renal pelvis, respectively In an earlier case (2478/1932), concerning a woman, 35 years old, suffering from right-sided hydronephrosis, one of us (TROELL) attempted to establish a free evacuation of urine from the renal pelvis by means of pelveo-ureterostomia lateralis However, this attempt failed A few days after the application of the anastomosis, urinary leakage was noted and nephrectomy had to be resorted to (favourable issue)

### Summary.

Two cases of hydronephrosis, viz , one with duplicated renal pelves and duplicated ureters, the other with a sharp kink formation of the ureter on the spot where it issued from the renal pelvis, high up in the medial, posterior wall In both cases, free passage of the urine was re-established by division of the ureter, belonging to the hydronephrosis The stump was sewn into the urinary bladder and the renal pelvis, respectively, after having made a short, longitudinal cut in the ureteral wall in order to form two lips Uneventful recovery and clinical restitution. 9 years later, the former considerable dilatation of the renal pelvis had, in both cases, been reduced

### Zusammenfassung.

Zwei Fälle von Hydroureterose der erste mit Verdoppelung des Nierenbeckens und des Ureters auf der einen Seite, der zweite mit scharfer Abknickung des Ureters an der Ort, wo er hoch oben an der medialen hinteren Wand das Nierenbecken verliess. In beiden Fällen wurde freier Abfluss des Harns dadurch zuwegegebracht, dass der dem Hydroureterosensack entsprechende Ureter quer durchgeschnitten wurde und dann der proximale (Fall I) bzw. distale (Fall II) Harnleiterteil — nach kurzer Langsspaltung zur Bildung zweier Lippen — in die Harnblase bzw. in den Hydroureterosensack implantiert und festgenäht wurde. Glatte Heilung und klinisch volle Restitutio. 9 Jahre später vorgenommene Nachuntersuchung zeigte, dass die früher bedeutende Nierenbeckenerweiterung in beiden Fällen bedeutend reduziert war.

### Résumé.

Deux cas d'hydroureterose, l'un avec double bassin et double uretère, l'autre avec une courbe aiguë de l'uretère à l'endroit où il sortait du bassin tout en haut de sa paroi postéro-interne. Dans les deux cas on rétablit le libre passage de l'urine en sectionnant transversalement l'uretère correspondant à l'hydroureterose et en implantant par suture son bout — qu'on avait fendu en long sur une courte distance pour former deux lambeaux — dans la vessie pour l'un des cas, dans le bassin pour l'autre.

Cicatrisation sans incident et guérison clinique. Neuf ans plus tard la dilatation du bassin, autrefois considérable, avait remarquablement diminué dans les deux cas.

Communication from the Surgical Department of the City Hospital  
of Bergen, Haukeland  
(Chief N BACKER-GRONDAHL, M D)

## The Influence of "Early Rising" on the Post-Operative Complications.

By  
N BACKER-GRONDAHL, M D,  
Chief Surgeon

Since I published in 1939 my experiences of early rising after operation, little has appeared on this subject, at any rate in the Scandinavian literature. Annual reports and remarks in publications suggest that this measure is gradually gaining ground and is being introduced in several hospitals in the various Scandinavian countries. On the other hand, no slight reserve is to be noticed in this field, a conservatism with a long tradition behind it. I have the impression that in conservative circles the whole subject is regarded with a certain distrust. Earlier, this feeling did not rarely find expression (KORTE 1913, MUNRO KERR 1922, several statements from the 1929 Congress of the Soc int de Chirurgie, e g FORGUE, DONATI and others, KRECKE in 1930 etc). The main trend of opinion is disbelief in the ability of this measure to achieve anything with regard to thrombo-emboli, and apart from them the subject lacks interest. FORGUE stamps this measure as something of a 24-hour stunt, and MUNRO KERR finds in it an expression of the "rush and bustle" of modern times. On the other hand, this measure has been the subject of much enthusiastic praise by men such as CHALIER, H PASCHOUD, CÂMPEANU, P SMITH, WICHMANN and a series of surgeons from Russia and other countries (Cf CÂMPEANU). When, however, we ask ourselves how much early rising really achieves, and if convincing figures can be put forward, we are

obliged to admit that they do not at present exist, at any rate in the form of comprehensive statistics. The only calculation which I know of, and which is constantly referred to, is by v JASCHKE from 1937. Here he shows how the percentage of fatal embolism cases has declined in his practice in various places. While he studied in Vienna, the mortality was 2 per cent for thromboses and 1 per cent for embolisms among late risers, whereas in a series of early risers (387 in all) it was 0.5 and 0 per cent respectively. Further, in GIESEN, where every patient got up at the end of the second week, the percentage of fatal embolisms was 1.4 in the period 1906—1912. This death-rate fell to 0.6 per cent in the period 1912—1918 when all the patients got up on the second to the fifth day. It has declined still further to 0.35 per cent in recent times when systematic respiratory exercises are carried out and the patient gets up on the day after operation. But it may with justice be objected that we are told nothing of the nature of the operations, whether their character has changed in the course of these years. Nor are we told what the nature of the anaesthesia was, nor whether the age incidence and relative numbers of the sexes were the same. All these factors play an important part with regard to these post-operative complications.

On the whole, there are many difficulties with such statistics. One can hardly compare figures from hospitals far apart, not to mention collective statistics from various countries. At any rate the figures must be big if they are to be useful. We are also told little of the nature of the operation, of the age and sex distribution etc. For this reason the figures for the post-operative complications vary considerably even when we limit ourselves to Scandinavia. A good example of this is to be found in the lists compiled by W. O. HELLSTEN in his study from 1942.

CĂMPEANU in 1941 says that 20,090 patients got up within 24 hours of operation. Among them were 6,508 who got up directly from the operation table, many being his own patients. He reproduces a list of these patients a considerable proportion of whom had been operated on for appendicitis and hernia, phrenicotomy and other operations were also included, the total being 3,570. Among them there was not one case of phlebitis, embolism, suture rupture or other serious complications. KUMMEL, taking part in a discussion in 1928, claimed that he could prove by statistics that, after appropriate movements and early rising, the frequency of embolism had declined to one-tenth of what it had been.

Even though we others who have also encouraged our patients to rise early can certainly not show such splendid results, there is yet every reason for us to make a searching study of the problem in order to ascertain if we achieve anything and how much. It is the more necessary to do so as the problem of how to avoid the most dreaded of all the post-operative complications — thrombo-emboli — has of late years again come much to the fore in Scandinavian surgical discussions. Heparin treatment, introduced as a prophylactic measure by JORPES and CRATOORD, is responsible for this state of affairs. The figures may seem to be quite convincing, but other results as, for example, from Denmark (AAGE NIELSEN and STARUP) have been emphasized. The most recent remedy, J. Lehman's kumarin-AP tablets, will also be of importance in this discussion of the prevention of embolism. As patients are allowed to begin early movements of varying degrees in bed, and in some cases are allowed to get up early, it is necessary to ascertain what this last measure alone can signify for the improvement of embolism statistics.

When I published my experiences in 1939, I did not believe that early rising would have any great influence on embolism. I maintained, however, that there were so many advantages in this measure that it should be employed. Six years have elapsed (since the autumn of 1937) in which this early rising has been practised in the Surgical Department of the City Hospital of Bergen, and it may therefore be well to ascertain what can be achieved thereby, particularly in the matter of post-operative complications.

Certain preliminary remarks must, however, be made. In the beginning we were somewhat hesitant and careful before we had gained sufficient experience, but the indications have been gradually much enlarged. Thus patients operated on for hernia were not included till 1939 on account of the scar problem. Since then, all these patients rise early without the scars becoming weaker. Indeed, we are under the impression that the relapses have become less frequent in the most recent years. As matters now stand, practically every patient undergoing an operation on head, neck, trunk and arms, and many whose legs have been operated on, get up on the first to the third day after the operation. Some patients are up and about from the time they leave the operation table, and this is always the case with patients whose varicose veins have been operated on. Patients with drained wounds, such as those after operations on the stomach and for appendicitis, get

out of bed on the second or third day when there is no severe peritonitis or the like. The problem is a little more difficult when drainage is required for profuse secretion as in operations on the gallbladder and the kidneys. Here each case must be taken on its own merits. Nor do we always advocate early rising after thoracoplastic operations as the patient's capacity to respond to increased respiratory activity may often be poor. A certain degree of fever is no contra-indication. Coughs, colds and slight bronchitis require early rising precisely because the patient coughs much more effectively when sitting, and the sputum is got rid of with much less trouble than in the recumbent posture. There are only a few contra-indications, and they will be discussed later.

There has been much discussion over what is meant by early rising. The ideal, with the patient walking from the operation table as required by HAVLICEK, PASCHOUD, CÂMPEANU, CHALIER and others, can be achieved by patients operated on for hernia, hydrocele, haemorrhoids, varicose veins and the like for which local anaesthesia is always employed. The same is the case with operations for appendicitis under local anaesthesia. But it is, of course, impossible to do so after inhalation narcosis, evipan or spinal anaesthesia. Practically all our operations on the abdomen and kidney are performed under spinal anaesthesia, and these patients lie on the day of operation in a mild degree of Trendelenburg's position. We do this because the dilatation of the vessels in the anaesthetized region is comparatively slow in passing off (MOENE), and raising the upper part of the body would therefore induce the blood to gravitate to the lower part of the body, threatening collapse. These patients may, however, be allowed up next day and are usually up on the second day. As spinal anaesthesia presents very great technical advantages for these operations, we have been disinclined to go over to the use of local anaesthesia in association with splanchnic anaesthesia or evipan.

In practically every case the patient gets up within seven days of the operation, — every patient with appendicitis without peritonitis, uncomplicated hernia, hydrocele and the like, every form of operation for cancer of the stomach, gastro-intestinal lesions even with perforation when no special treatment is required for these lesions. Early rising was achieved in 56 per cent of the cholecystectomies, 47·2 per cent of the operations on the kidneys, and 90 per cent of the prostatectomies. In these cases, 60 to 80 per cent of the patients are out of bed before the end of the third

day A few must, of course, go to bed again for a day or more, but they hardly represent 10 per cent of the total The trouble is principally with complications referable to the blood, vessels or lungs They are quite rare as we shall see later Then there may be colds, wound complications such as haematomata or infections, attacks of pyelitis etc Headache is rare, and most patients can stand being up with some degree of headache

At first it was not easy to get the patients up, for they and doctors are accustomed to the notion that one should lie for some time and rest after an operation Quite soon, however, the patients became accustomed to the idea of early rising, and they appreciated it They often compete among themselves as to who is most enterprising, and they constantly ask to be allowed up This has its effect on the general public, diminishing the fear of operation and the dread of admission to hospital

But the patient must not, however, have already spent a long time in bed When this is the case, it is best to delay the operation for some time and meanwhile to induce the patient to be up and about

There are, on the whole, few contra-indications Severe anaemia, uncompensated heart disease, high fever, great debility and paralyses are the most important

As already mentioned, there are many difficulties in the way of providing sufficiently reliable statistics concerning the results of early rising The most suitable procedure would be to divide hospital material into two groups, letting the patients in one group get up early after operation, and the patients in the second group remain in bed Or two surgical departments might undertake such a comparison We are unable to follow this second plan Nor have we wished to follow the first, partly because it would take too long to reach sufficiently high figures, partly because we do not wish to expose our patients to the increased risk of post-operative complications entailed by remaining a long time in bed after operation

We have therefore decided to compare the results of operations before and after the patients began to rise early For this comparison we have chosen three different groups of patients all of whom have been kept under close observation In the first group, the operations performed were for cancer of the stomach, in the second for ulceration of the stomach and duodenum, and in the third for uncomplicated femoral and inguinal hernia in patients over 20



The period covered is from October 1927 to October 1943. As already mentioned, we began to practise early rising for the first two groups at any rate in the autumn of 1937, and for the third group not till 1939.

During this period, there has been very little change in the principles followed for operation in the three groups. In over 90 per cent of the ulcer patients, resection according to Billroth II in the main has been employed, and of late years for most of the cases of perforation. The technique of the operation itself has undergone no important change. Also for cancer of the stomach resection was performed in over 45 per cent and whenever it was possible to do so for reasons stated in another publication.

Before 1930, ether narcosis was usually employed. Later, spinal anaesthesia took its place almost completely, in some cases in association with gas-ether narcosis when the spinal anaesthesia had not lasted long enough. The anaesthetic employed is a 1/1,500 slightly hypotonic solution of pelkain in quantities of 10 to 16 c c in the lateral posture or according to HOWARD JONES. With the exception of perforated ulcers of the stomach and duodenum, practically all the operations were performed by myself.

The treatment before and after operation has also not changed much. As a rule, the patient is given a 5 per cent solution of glucose by drop enema after the operation during the time he cannot drink. Injections of large quantities of fluid are given only for severe haemorrhage, and few blood transfusions have been undertaken. In the early thirties, large intravenous or subcutaneous injections of saline solution were given for a time, but as they seemed to help but little (OWRE) and the patients suffered considerable discomfort, they were discontinued. For the hernia operations there has been practically no change in the anaesthesia, the operation technique and the after-treatment. These operations are performed under local anaesthesia. As early rising was instituted recently for these patients, there are few of them compared with the patients in the other two operation groups.

It will thus be seen that the three groups are approximately as uniform as can be required for a comparison.

Another main problem concerns the impartial evaluation of the complications. We believe it has been so. It has in the main been undertaken by one and the same person and on uniform principles. The symptom-complex of thrombo-embolism was fully understood at the time when these investigations were started.

The same distinction has been made between thrombophlebitis and thromboses as that accepted by other Scandinavian investigators (SEMB, WESTBERG, HARBITZ and others) thrombophlebitis being regarded as a superficial lesion in the sinuous veins in the skin and superficial tissues, while thromboses concern the deep-seated and straight veins. It is unnecessary to discuss in detail the signs which have been regarded as diagnostic, for their evaluation has been so uniform. Venography was, however, not employed.

It is more difficult to diagnose pulmonary embolism. Is it to be diagnosed when an otherwise apparently healthy person, without cough, expectoration, haemorrhage or a rise of the pulse-rate complains of pain in the chest lasting a few to 24 hours? We have diagnosed pulmonary embolism in such cases when a rise of the sedimentation rate has been demonstrated at the same time or a little later. This interpretation is supported by the investigations of N. WIG, and we have found this test of much value in such cases. Nor have we ever had to regret it when we have assumed that the pain was not due to embolism and have let the patient get up directly after operation. We have also not regarded broncho-pneumonias or limited pneumonias as sequels to embolism when a radiological examination has failed to demonstrate a pulmonary infiltration resembling an infarct. This point is, however, of little importance as in these cases also uniformity of evaluation was assured throughout the period under review.

Do a certain number of complications escape observation because they do not appear till after the patient has been discharged from hospital? As far as we know, this has happened twice in the period under review, and in neither case did the patient belong to the material studied. It seems unlikely that anything of the sort should happen without the hospital being informed of it.

The real difficulty with this statistical procedure lays in quite another sphere. As already mentioned, the patients were classed in two groups, the early and the late risers. But in this lies hidden a danger which may render our calculations worthless. May not the incidence of the complications be such that some of them arise early — before the patient has a chance to get up? Such patients must, of course, remain in bed, and their complications may be recorded as belonging to the so-called late risers, discrediting this group unfairly. As KIRSCHNER and others have pointed out, embolism may occur during the first or the first three days. He considers the third day as the most dangerous (cit. FORGUE). P

BULL, J NICOLAYSEN and others have also had this experience, and such embolism usually sets in without previous symptoms. Thromboses are seldom demonstrable before the fourth — fifth day (BULL, WESTBERG). To avoid this mistake, we have not included those cases of embolism in which the symptoms thereof or death occurred during the first three days after operation when the patients had not been up and about earlier. But when they have been so, the complications are listed with the early risers, but there have, for that matter, been only a few such cases set apart thus. The same principle has been adopted with such pulmonary complications as bronchitis and broncho-pneumonia which set in so early that the patient may be said to have brought them with him. Deaths are not listed with the late risers, but it is so with the early risers if the patient has first been up and about.

It is conceivable that another source of error arises in this way that the old and feeble remain in bed while young folk rise early. As the risk of embolism increases with age, the late risers would be unfairly handicapped. A somewhat similar mistake could be made if we encouraged early rising for the subjects of comparatively slight operations such as gastro-jejunostomy while we kept in bed the subjects of resection of the stomach for cancer. But neither of these objections is applicable to my material as practically all the patients operated on are early risers. It will be seen in the tables that the resection percentage for cancer is, to a certain extent, higher for the early than for the late risers. The average age for patients operated on for hernia is higher among the early than the late risers.

The dividing line between the early and the late risers I have put at the end of the fourth day after operation. In 1939, I put it at the seventh day, but I have found this too late. No definite dividing line has been drawn in this field. CHALIER, CÂMPEANU, PASCHOUD, WOHLLEBEN and others count rising as early within 24 hours. Others allow a longer interval (ARNESEN, P SMITH and WICHMANN hold that one can allow more than 24 hours). I would prefer to put the limit at the end of the second day, but this would reduce my figures, and I have therefore chosen a longer interval.

In the following tables I have not included deaths from other causes such as peritonitis, uraemia etc. For here we are not concerned with operation mortality in general, but only with certain groups of complications.

Table 1 deals with operations for cancer of the stomach, a considerable proportion being, as already mentioned, resections

The table plainly shows how great the difference is between the early and late risers both with regard to morbidity and mortality for both blood-vessel and pulmonary complications. The average age of the early risers is seen to be higher rather than lower than that of the late risers.

Table 2, which deals with operations for gastric and duodenal ulcer, shows exactly the same result. As there is little difference between the uncomplicated and the perforated ulcers, we are justified in lumping them together, securing large enough figures thereby. Here it has been unnecessary to calculate the average age in the various groups. Resection was practised in over 90 per cent. of the cases.

In the third group are operations for nonincarcerated inguinal and femoral hernia in persons over 20, under this age complications referable to the blood vessels hardly ever occur.

This table shows that thrombo-embolism is more common after operations for femoral hernia than for inguinal hernia. Both HARBITZ and B. BERGQUIST have found the same. It is generally agreed that the danger of embolism is greater for bilateral than for unilateral operations. Many of the patients in this table were operated on at the same time on both sides, but there is, however, nothing to be gained by classing them by themselves as among them there was only one case of embolism. The average age was higher for the early risers, 4.2 per cent. of whom had to go to bed again for a shorter or longer spell. The indication for this was embolism only in one case. The other indications were haematoma of the wound, biliary colic, haemoptysis due to pulmonary tuberculosis, etc.

All these groups show the same result, with much fewer complications for the early risers. This is also plain when the figures are represented graphically in columns as in the following chart in which the percentage is indicated on the vertical line and the late and early risers in the three groups are placed side by side.

In the groups classed together, the figures have been checked by standard error calculations recorded by the side of the figures.<sup>1</sup>

<sup>1</sup> These calculations were carried out by the statistician, Herr H. OLSEN at Norges Handelshøyskoles Forretningsøkonomiske Institut.

Tab 1  
Operations for cancer of the stomach Post-operative groups

	Number of oper	Phlebitis			Thrombo-embolism			Deaths			Pneumonia			Deaths			Broncho-pneumonia			Deaths			Average age in years
		Number	%	Stand error	Number	%	Stand error	Number	%	Stand error	Number	%	Stand error	Number	%	Stand error	Number	%	Stand error	Number	%	Stand error	
<i>Exploratory laparotomy</i>	39	2	—	3	—	5	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	53 8	
Late Risers	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	56 6	
Early ,																							
<i>Gastro-jejunostomy</i>	32	—	7	—	5	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	55 1	
Late Risers	7	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	53 9	
Early ,																							
<i>Resection ventriculi</i>	57	5	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	50 9	
Late Risers	34	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	51 2	
Early ,																							
Total number	184	9	—	10	—	—	—	7	—	—	2	—	—	1	—	—	5	—	—	2	—	—	

*All the operations for cancer of the stomach 184 — 7 deaths from other causes*

Late Risers	121	7	5	79	±	2	12	9	7	44	±	2	39	6	4	96	±	1	98	2	1	65	±	1	17	4	3	31	±	1	63	2	1	65	±	1	17
Early	56	2	3	57	±	2	48	1	1	79	±	1	79	1	1	79	±	1	79	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	177	9						10						7					2									5									

	Number of operat	Cardio-vascular complic			Deaths			Pulmonary complic			Deaths		
		Num-ber	%	Stand error %	Num-ber	%	Stand error %	Num-ber	%	Stand error %	Num-ber	%	Stand error %
Late Risers	121	16	13	22	±	3	08	6	4	96	±	1	98
Early	56	3	5	35	±	3	00	1	1	79	±	1	79
Total number	177	19			7			7					

	Number of operat	Cardio-vascular and pulmonary complice				Deaths		
		Number	%	Standard error %	Number	%	Standard error %	
Late Risers	121	22	18 18	± 3 59	9	7 44	± 2 39	
Early >	56	4	7 14	± 3 44	1	1 79	± 1 79	
Total number	177	26			10			

Tab. 2  
Operations for gastric and duodenal ulcer Post operative groups

	Numb of operat	Phlebitis			Thrombo embolism			Deaths			Pneumonia			Deaths			Broncho-pneumonia			Deaths		
		Number	%	Stand error %	Number	%	Stand error %	Number	%	Stand error %	Number	%	Stand error %	Number	%	Stand error %	Number	%	Stand error %	Number	%	Stand error %
Gastric ulcer																						
Late Risers	121	4			5						1						13			3		
Early ,	64	1															1			1		
Penforating gastric ulcer																						
Late Risers	29				1												2					
Early ,	8				1																	
Duodenal ulcer																						
Late Risers	145	5			4												9			1		
Early ,	88				1												4					
Penforating duodenal ulcer																						
Late Risers	71	2			4												10			1		
Early ,	35				2						2						3			1		
Pyloric ulcer and combined ulcers																						
Late Risers	39	3			3												3					
Early ,	11																					
	611	15			21			1			3			2			45			6		

*All the ulcers*

Late Risers	405	14	3 46 ± 0 91	17	4 20 ± 1 00	1	0 25 ± 0 25	3	0 74 ± 0 43	2	0 49 ± 0 35	37	9 14 ± 1 43	5	1 23 ± 0 50
Early	206	1	0 19 ± 0 49	4	1 94 ± 0 96	—	—	—	—	—	—	8	3 88 ± 1 34	1	0 49 ± 0 49
Total number	611	15	21	—	—	1	—	3	—	2	—	45	—	6	—

	Number of operat	Cardio vascular compic			Deaths			Pulmonary compic			Deaths		
		Num-ber	%	Standard error %	Num-ber	%	Standard error %	Num-ber	%	Standard error %	Num-ber	%	Standard error %
Late Risers	405	31	7 65	± 1 32	1	0 25	± 0 25	40	9 88	± 1 48	7	1 73	± 0 65
Early	206	5	2 43	± 1 07	—	—	—	8	3 88	± 1 34	1	0 49	± 0 49
Total number	611	36	—	—	1	—	—	48	—	—	8	—	—

	Number of operat	Cardio-vascular and pulmonary compic				Deaths		
		Number	%	Standard error %	Number	%	Standard error %	Standard error %
Late Risers	405	71	17 33	± 1 89	8	1 98	± 0 69	± 0 69
Early	206	13	6 31	± 1 69	1	0 49	± 0 49	± 0 49
Total number	611	84	—	—	9	—	—	—



Tab. 3

Operations for *Inguinal and Femoral Hernia of Persons over the Age of 20*

	Number of Oper	Phlebitis			Thrombo embolism			Deaths			Pneumonia			Broncho-pneumonia			Deaths			Average age	
		Number	%	Stand error %	Number	%	Stand error %	Number	%	Stand error %	Number	%	Stand error %	Number	%	Stand error %	Number	%	Stand error %		
<i>Inguinal Hernia</i>																					
	Late Risers	715	10		121			1			23			125			1			41	53
	Early ,	187	31		1			—			—			—			—			45	2
<i>Femoral Hernia</i>																					
	Late Risers	83	2		5			—			—			1			—			42	7
	Early ,	34	1		—			—			—			—			—			49	4
Total number	1,019	14			27			1			3			26			1				

*Inguinal and femoral hernia Together*

Late Risers	796	12	1.51 ± 0.13	26	3.27 ± 0.63	1	0.13 ± 0.13	23	0.38 ± 0.22	26	3.27 ± 0.63	1	0.13 ± 0.13
	221	2	0.91 ± 0.64	1	0.45 ± 0.45	—	—	—	—	—	—	—	—
Total number	1,017	14		27		1		3		26		1	

	Numbers of Operat	Cardio-vascular complications			Deaths			Pulmonary complic			Deaths		
		Num-ber	%	Stand error	Num-ber	%	Stand error	Num-ber	%	Stand error	Num-ber	%	Stand error
Late Risers	796	38	4.77	± 0.76	1	0.13	± 0.13	29	3.64	± 0.66	1	0.13	± 0.13
Early ,	221	3	1.36	± 0.78	—	—	—	—	—	—	—	—	—
Total number	1,017	41			1			29			1		

	Numbers of operat	Cardio-vascular and pulmonary complic				Deaths		
		Number	%	Standard error		Number	%	Standard error
Late Risers	796	67	8.42	± 0.98		2	0.25	± 0.18
Early ,	221	3	1.36	± 0.78		—	—	—
Total number	1,017	70				2		

<sup>1</sup> Three emboli between the first and third days not included  
<sup>2</sup> To be exact, seven, of which four are not included  
<sup>3</sup> The 67th day in an advanced case of cancer of the stomach  
<sup>4</sup> Occurred on the first day 1 Not included  
<sup>5</sup> 798 — 2

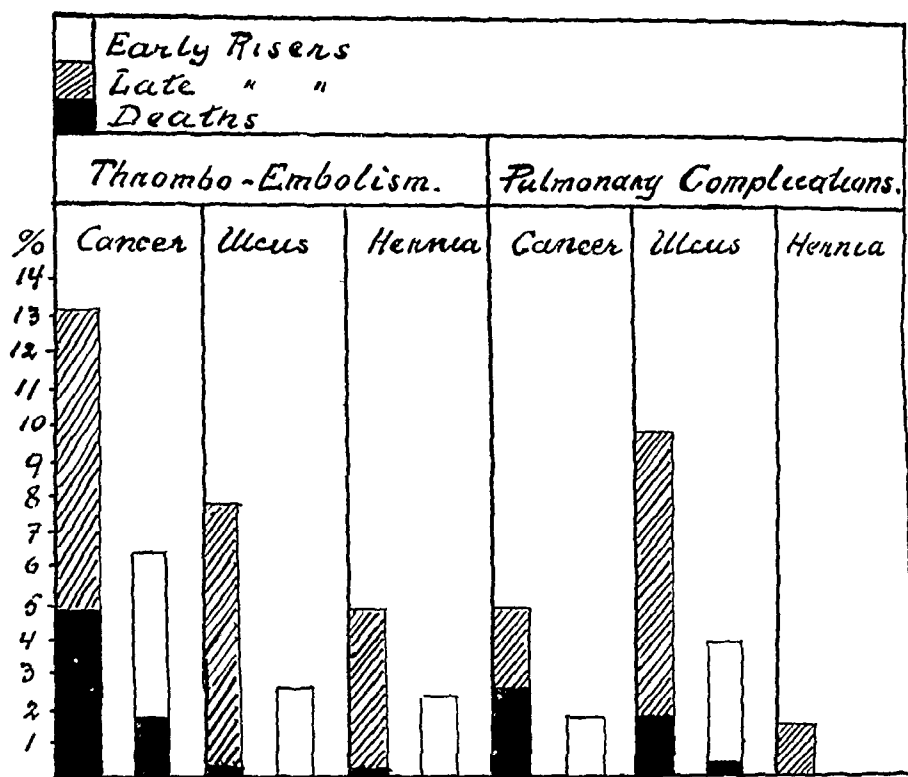


Chart 1

It may in general be claimed from the results of this investigation that early rising as hitherto practised at the Surgical Department of Haukeland Hospital has reduced the incidence of thrombo-emboli and pulmonary complications to about one-third of what it was earlier.

This result coincides for that matter with the findings of earlier investigators. Reference has already been made to v. JASCHKE's figures. PASCHOUD states that his general operation mortality has fallen in the course of a few years from 4.96 per cent to 1.71 per cent in association with early rising after operation combined with infra-red or ultra-violet irradiation while the patients were up and about. He believes that the irradiation helps to induce, among other things, a freedom from pain (post-operative analgesia) which facilitates early rising.

We believe that our investigations, as carried out, cannot be interpreted in any other way than that early rising really effects a quite considerable improvement with regard to these post-operative complications.

It is not perfectly clear, especially with regard to the thrombo-emboli, how these changes are in reality produced, and this is not the place for a more detailed study of this problem. But I would like to touch on certain points.

Everyone interprets the processes leading to thrombo-emboli in the same way, assuming that the vaso-motor system is influenced in such a way that the blood pressure and circulation of the blood are maintained by the tone of the blood vessels. WICHMANN speaks openly of vaso-motor insufficiency, and CÂMPEANU employs the expression "Wiederinfunktionssetzung des peripheren Herzens". The usual fall of the blood-pressure, with which we are familiar in patients confined to bed, does not overtake the early risers.

It is most important to know how the tone of the blood vessels is kept up, but we don't know very much about this. There are certainly in the sinus caroticus and the arch of the aorta vaso-pressor nerve centres of the greatest importance to tone, particularly in the upright posture. In this connexion it is immaterial whether the reflex depends on the gland carotica (HERING and DE CASTRO 1925) or arises from the wall of the sinus itself (DE CASTRO 1928, cit. A. CHRISTENSEN) or is derived from the aorta. The main point is that this reflex has, to a certain extent, been acquired by man, and that it is instantaneous in healthy persons. Confinement to bed, among other factors, may suppress it completely or partially, and it must be acquired anew, taking some time to do so, often a several days. Operation shock is most intimately connected with vaso-motor tone, and the combating of shock therefore entails keeping up the blood-pressure. As REHN says "Zur Konstanterhaltung des Blutdrucks ist eine Hin- und Herbewegung der Blutmenge erforderlich".

The investigations of FRIMANN-DAHL have shown that prolonged confinement to bed, particularly in association with a strict diet, may induce a considerable slowing down of the circulation in the veins of the lower limbs even without an operation. After an operation there is also such a slowing down of the circulation of the blood at any rate from the second day and most marked on the third to the fifth day. This lasts till the patient leaves his bed and begins to walk. FRIMANN-DAHL found the cause of this phenomenon less in diminished movements of the diaphragm than in the inactivity and, perhaps, diminution of the quantity of blood in circulation. Muscular contractions promote the circulation, but

the most definitely permanent improvement occurs as soon as the patient gets up and can walk

Perhaps the most essential symptoms of the "post-operative disease" described by LERICHE are merely a consequence of this diminution of the quantity of blood in circulation PASCHOUD maintains that this is so, and he notes that the symptoms often begin after a so-called free interval from the second day onwards There are good reasons for believing that early rising, even if it does not completely banish this post-operative disease, will at any rate shorten it and diminish its manifestations to a considerable extent This is the strong impression given us as we watch these early rising patients They must not, however, have been confined to bed for some time before operation

The fact that the frequency of pulmonary complications also is so greatly diminished by early rising can hardly be credited to the diminution in the number of emboli To be sure, it has commonly been held that a considerable proportion of these pulmonary complications resulted from small, overlooked emboli Personally, I believe the explanation is to be found in the post-operative condition of the diaphragm Towards the end of the 'twenties, CHURCHILL and DONALD McNEIL showed that the excursions of the thorax were diminished after an operation, and OVERHOLT found that a considerably reduced vital capacity was due both to upward displacement of the diaphragm and to a diminution of its range of movement PATEY observed the same phenomenon in 1930 EPPINGER (31) and CAPPELE (33) came to the same conclusion in Germany FRIMANN-DAHL's investigations illuminated this phenomenon more fully It is already fully developed on the first day, and can be seen on the X-ray screen to persist from a couple to many days after the operation The nature of the anaesthesia did not affect this phenomenon as it was observed after local anaesthesia also It is not necessary to investigate the underlying causes of this phenomenon, whether it be due to air in the peritoneal cavity (LAURELL, OVERHOLT), to pain, or meteorism (WAHREN) In 1938, IRSIGLER stated that this phenomenon disappeared if the diaphragm were relieved from the pressure of the abdominal organs by putting recently operated patients in a sitting posture Many have maintained that this post-operative upward displacement of the diaphragm gives rise to atelectatic areas in the lower parts of the lungs FRIMANN-DAHL could not, however, demonstrate this radiologically Knowing as we do how impor-

tant a part these structures play in the ventilation of the lungs (HUSFELDT and WANDALL), it is obvious that this limitation of movement is harmful and may prove fatal KRIEGER LASSEN's investigations point in the same direction His observations on Danish operation material tallied completely with the American investigations, the only difference being this that the Danish patients took even longer to recover their normal vital capacity

We have investigated the possibility of a difference between late and early risers with regard to their post-operative vital capacity, in particular trying to find out if a return to normal is hastened by early rising We have, however, had to employ the American material for the purpose of control as it is long since our patients gave up late rising, and we have not wished to subject a whole series of them to prolonged rest in bed with all its discomforts The comparison we thus draw should, according to KRIEGER LASSEN's investigations, be perfectly permissible The patients were examined with an ordinary spirometer on the day before the operation and every other day after it for 9 to 11 days The vital capacity was measured in the recumbent posture in bed, while the patient sat up in bed, and one hour after he had been up and had lain down again The average of three measurements was taken each time, and certain quite interesting observations were made The patient's vital capacity was, as expected, somewhat greater when he sat up It was remarkable that even after he had got to bed and had lain there for an hour, his vital capacity was still in most cases greater than it had been before he got up This phenomenon was so persistent that it is reflected in the curve It was further noted that, as expected, the vital capacity returned sooner to the normal starting-point in the early risers than in the controls represented by investigations hitherto recorded The curves of CHURCHILL and McNEIL (calculated as percentages) and of OVERHOLT (in c c) are absolutely identical They tally, as already mentioned, with those of KRIEGER LASSEN, at any rate in the beginning, but there is a difference in their subsequent behaviour in that the vital capacity of his patients "rarely returned after large operations to the starting-point before they were discharged from hospital"

The only patients we examined were such as had undergone operations on the upper abdomen (24 resections for gastric ulcer) Chart 2 gives the curves for several of these patients, the measurements being taken in the recumbent posture before they had left

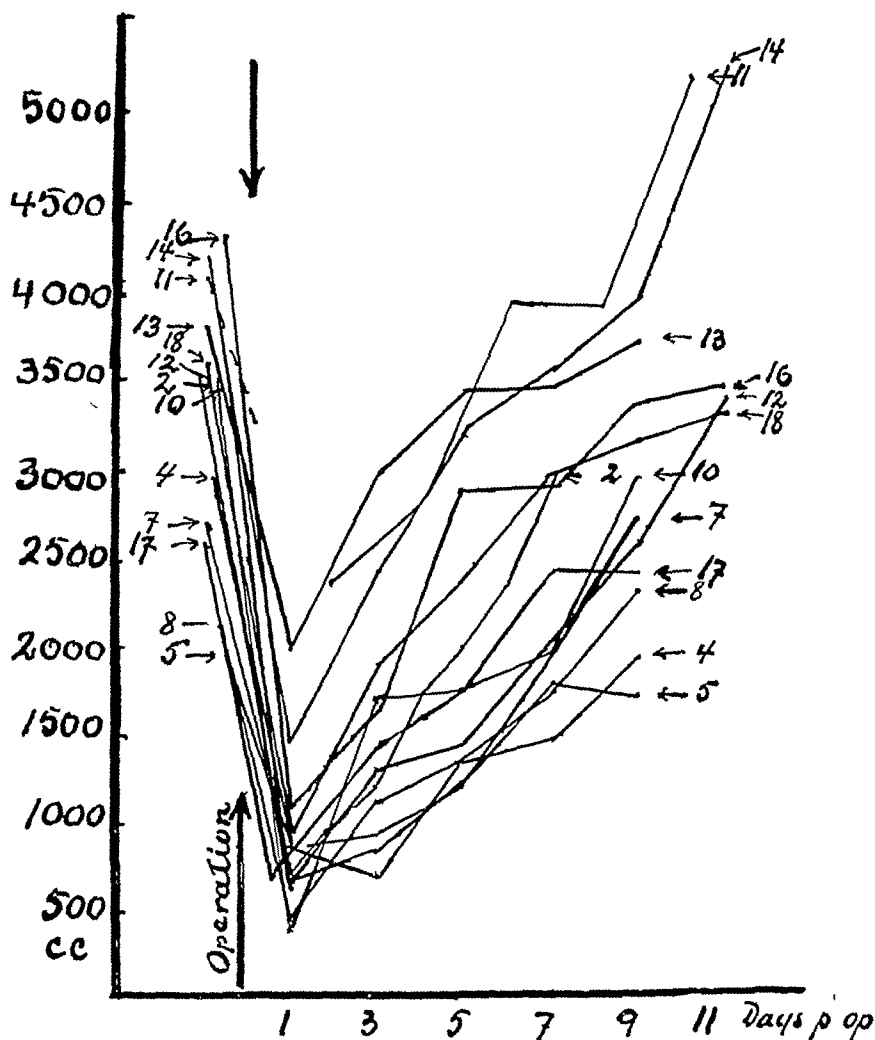


Chart 2 Spirometric curves for 12 gastrectomies for ulcer measured in c c of air

their beds. It will be seen that all these curves are comparatively uniform. The average values of all the curves representing the three different measurements are indicated in chart 3. At the same time, OVERHOLT'S curve for 56 "upper abdominal operations" has been drawn in. It will be noted how much sooner the curve for the early risers has returned to the starting-point. This difference would be still greater were KRIEGER LASSEN'S curves to be employed. This rapid return of the curve for the vital capacity can only mean that the normal movements of the diaphragm begin again sooner in the early risers, the ventilation of the lungs im-

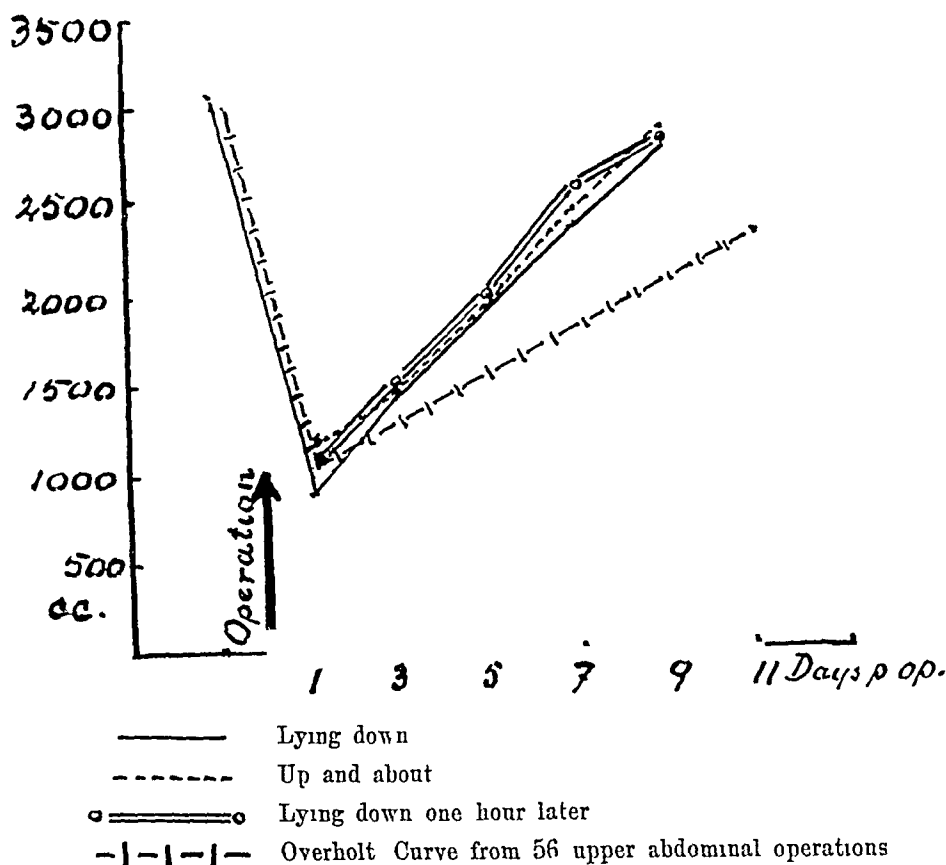


Chart 3 Curve indicating the average figures for spirometric measurements of 24 resections of the stomach for ulcers

proving as fear of using the abdominal muscles diminishes, meteorism grows less and respiration becomes more free. It is assuredly most legitimate to assume that this is an important, and probably the most important, factor reducing the incidence of pulmonary complications.

Evacuation of the bowels and bladder also begins sooner and more easily when the patient gets up early. There is less nausea, it is not necessary to use the stomach pump so often, the patient can begin to eat sooner, etc. On the whole, the sympathetic functions are much better, returning sooner to normal than when the patient remains in bed. The scope of this study does not permit of further details.

Mention has already been made of the comparatively rare contra-indications. Neither age nor the slight febrile reactions, as most frequently seen after a major operation, are contra-indi-



cations It has always been the rule to encourage early rising after operations on the bladder and prostate, and no harm has ensued We have only once seen rupture of the operation wound, the patient in this case being a man aged 72 who had undergone resection of the stomach for cancer, and who had got up on the seventh day He returned to bed on the thirteenth day because of rupture of the operation wound due to cough, and he died of pulmonary embolism on the fifteenth day He was mentioned in my lecture in 1939, but he cannot be included among the early risers We have not seen any heart complications

In 1940, S HARILD raised this objection to early rising that it is opposed to physiological conditions in the post-operative period during which the consumption of oxygen is reduced in most cases, and the minute volume of the heart is diminished This reduction reaches its peak about the fourth day and is, as a rule, but far from always, absent about the seventh to the tenth day after operation He believes that this diminution of the minute volume is in the main due to a peripheral circulation insufficiency for which there may be several causes The patient should therefore in his opinion remain in bed till this defect of the circulation of the blood has been repaired

It seems to me that this objection is based only on the theory that the cause itself of the trouble, i e the defectiveness of the circulation of the blood, is irreparable But it is just this defect one seeks to repair by early rising All agree that the maintenance of the tone of the blood vessels aimed at is actually achieved Nor did PASCHOUD see any fall of the blood pressure after operation The investigations of FRIMANN-DAHL, already referred to, point the same way We, too, have not encountered any difficulties of this kind

It is important to note in this connexion that there is a great difference in the effect of exercises in bed and of early rising The first promote the circulation of blood, at any rate in the muscles used, but they have no general effect on the tone of the blood vessels FRIMANN-DAHL's studies show this quite clearly As nearly all surgeons are keen advocates of muscle exercises, for which innumerable devices have been constructed, it would be consistent on their part to go over to early rising In this respect R FRYKHOLM's advocacy of raising the head of the bed to prevent embolism is logical

It is hardly necessary once more to point out that the operation

scars become at least as firm after early as after late rising. We are under the impression that post-operative recurrences of hernia have become rarer since we started early rising.

We need not dwell in detail on the encouraging influence of early rising on the patient, of the stimulation of his vital functions, of the comparatively early return of appetite, and of the much lessened sense of illness. Capacity for work is also restored sooner.

But there is also another and an important factor, the social-economic. The patient is able to return to work sooner, and the number of days of illness and the financial contribution from the community are reduced.

A much more effective employment of hospital beds is assured, witness the following:

The average post-operative stay in bed of 100 late risers whose stomachs were resected was 12.6 days. They were discharged on the 20.79th day.

The average post-operative stay in bed of 100 early risers whose stomachs were resected was 2.11 days. They were discharged on the 14.65th day.

Thus six days' stay in hospital per patient (32 per cent) were saved.

Fifty late risers operated on for hernia got up on the 14.5th day and were discharged on the 16.9th day after operation.

Fifty early risers operated on for hernia got up on the 3.4th day and were discharged on the 8.5th day after operation, — a saving of 8.4 days per patient (50 per cent).

All this means a great economy for the community.

This investigation, which deals with three important groups of diseases for two of which major operations have been performed mainly under spinal anaesthesia and for one of which less serious operations were performed, all under local anaesthesia, has yielded such mutually confirmatory findings that it is permissible to draw definite conclusions.

By early rising, the risk of thromboembolism and of pulmonary complications is reduced to about one-third of what it was earlier.

It must be admitted that this measure does not wholly eliminate embolism. For there are always a few cases in which embolism occurs during the first few days after operation (in the whole of our material there were three cases of embolism occurring on the first, the second and the third day respectively after operation without fatal issue; the operation was for inguinal hernia in every

case, and none of the patients had been confined to bed before the operation) But it is probable that the risk of embolism would be still further reduced if the patients could get up after a shorter interval than the one we have chosen as the basis for our calculations in the present study The ideal would be to get the patient out of bed before the end of the first day after operation

But even short of this, early rising constitutes so great a gain, both with regard to embolism and pulmonary complications and to many other factors, that there is every reason for adopting it as a general rule

We shall then be able, like CÂMPEANU, to speak of a "biological era" for surgery or, like PASCHOUD of a "revolution d'Hôpital"

### Summary.

Since the autumn of 1937, the patients at the Surgical Department of the City Hospital of Bergen have been encouraged to rise early after all the operations when this has been feasible Some of the patients have walked from the operation table, and practically all have got up and about in the course of four days

The author has investigated the effects of this measure on such post-operative complications as phlebitis, thrombo-embolism and diseases of the lungs To assure himself of impeccable material, he has selected three groups of disease, — cancer of the stomach (in all 177 cases), gastric and duodenal ulcer (611), and non-incarcerated inguinal and femoral hernia in patients over the age of 20 (1017) He has compared the results for the late risers before 1937 with those for the early risers He finds that the age and sex incidence, the nature and technique of the operations, and the character of the anaesthesia have undergone little change between 1927 and the present time Resection was performed in over 90 per cent of the cases of ulcer, and in 45 per cent of the cases of cancer Throughout the period under review, the standard by which the manifestations of disease have been judged has been uniform The cases of embolism and pulmonary complications occurring during the first three days after operation, at a time when the patient could not, perhaps, be up and about, are not included in the calculations unless these ailments overtook early risers who had been out of bed before the onset of symptoms By "early rising" is meant getting up before the end of the fourth day

after operation. It is, however, admitted that the ideal would be a shorter interval, but then the figures would have been small.

A comparison of the late with the early risers showed wholly identical results for all three groups of disease. Both thromboembolism and pulmonary complications fell to about one-third of their frequency in the late rising period.

For embolism, the cause of this fall is sought in the maintenance of vaso-motor tone.

For pulmonary complications, the explanation is that early rising assures better conditions for the respiratory movements of the diaphragm and for the supply of air to the lower parts of the lungs. Measurements of the vital capacity of 24 patients for whom resection was performed for gastric ulcer showed that the spirometric curve returned to normal much sooner among the early risers than among the late risers examined by American and Danish observers.

The length of stay in hospital after operation was reduced from 30 to 50 per cent.

Early rising offers so many advantages by reducing post-operative complications and the length of stay in hospital, by hastening the patient's return to work, by diminishing his sense of invalidism and by other factors that every surgeon would do well to adopt this measure.

### Zusammenfassung.

An der chirurgischen Klinik des städtischen Krankenhauses in Bergen, Norwegen, hat man seit dem Herbst 1937 alle Patienten nach allen Operationen, bei denen dies praktisch durchführbar war, früh aufstehen lassen. Zum Teil standen die Patienten gleich vom Operationstisch auf, im Verlaufe von 4 Tagen waren fast sämtliche Patienten aufgestanden.

Der Verfasser untersucht in seinem Material welche Bedeutung das Früh-aufstehen auf postoperative Komplikationen, wie Phlebitis, Thrombose-Embole und Lungenkrankheiten hat.

Um ein möglichst fehlerfreies Material zu erhalten, greift der Verfasser 3 Krankheitsgruppen: Cancer ventriculi (177 Patienten), Ulcus ventriculi s. duodeni (611 Patienten), und nicht incarcerierte Brüche (inguinale und femorale bei Patienten über 20 Jahren, 1017 Patienten), heraus und, vergleicht die Behandlungsfolgen der Patienten, die vor dem Jahre 1937 spät aufstanden mit

denen der Früh-aufgestandenen Sein Material zeigt in den Jahren 1927 bis 1943 nur unbedeutende Veränderungen in Bezug auf Alter, Geschlecht, Operationsart und Technik sowie Anästhesie. In über 90 % der Ulcera und 45 % der Cancerpatienten wurde eine Resektion ausgeführt. Die kritische Auswertung der Symptome war in allen diesen Jahren ganz dieselbe. Die Embolien oder Lungenkomplikationen, die in den ersten 3 Tagen post operationem einsetzen, d. h. zu einem Zeitpunkt, an dem die Patienten möglicherweise noch nicht hatten aufstehen können, sind nicht mitgerechnet mit Ausnahme von Fällen bei frühen Patienten, die schon vor dem Beginn der Symptome aufgestanden waren.

Als »Frühaufstehen« bezeichnet der Verfasser alle Fälle, an denen der Patient innerhalb des Ausganges des vierten Tages nach der Operation aufgestanden war. Eine weitere Begrenzung dieses Zeitraumes wäre ein Vorteil, doch wurden dadurch die Zahlen im Material des Verfassers zu klein werden.

Bei dem Vergleich der Spät- und Früh-aufgestandenen findet der Verfasser ganz übereinstimmende Resultate in allen 3 Krankheitsgruppen. Sowohl Thrombose-Embolien wie Lungenkomplikationen fallen bei Früh-aufgestandenen bis zu einem Drittel der Komplikationen bei den Spätaufgestandenen.

Den Grund für die Verbesserung der Verfasser glaubt man bei Embolien in der Ausrechterhaltung des vasomotorischen Tonus sehen zu müssen.

In Bezug auf die Lungenkomplikationen nimmt man der Verfasser an, dass das Frühaufstehen bessere Bedingungen für die Atmungsausschläge des Zwerchfells und eine bessere Durchlüftung der unteren Lungenabschnitte bedingt. Kontrollmessung der Vitalkapazität von 24 resezierten Ulcera zeigt, dass die Spirometerkurve bei Frühaufgestandenen Patienten bedeutend schneller normale Werte erreicht im Vergleich mit amerikanischen und danischen Untersuchungen, die an Spät-aufgestandenen ausgeführt wurden.

Die Dauer des Krankenhausaufenthaltes wird mit 30—50 % verkürzt.

Durch die Herabsetzung der postoperativen Komplikationen, seine Ersparung an Krankenhausaufenthalt, die schnellere Rückkehr der Kranken zur Arbeit, durch vermindertes Krankheitsgefühl u. s. w. bedingt das Frühaufstehen so viele Vorteile, dass diese Behandlungsweise von allen Chirurgen durchgeführt werden sollte.

## Résumé.

Au service de chirurgie de l'hôpital communal de Bergen, depuis l'automne 1937 les malades se lèvent précocement après toutes les opérations où ceci est faisable. Certains quittent déjà à pied la table d'opération et au cours des 4 premiers jours pour ainsi dire tous sont debout.

L'auteur examine la mesure dans laquelle cette façon de procéder a eu de l'influence sur les complications post-opératoires telles que phlébites, thrombo-embolies et affections pulmonaires.

Pour éviter autant que possible toute cause d'erreur provenant du matériel examiné on choisit 3 groupes de maladie-cancer de l'estomac (en tout 177 cas), ulcères de l'estomac ou du duodénum obtenus chez ceux qui se sont levés précocement avant 1937 à (611) et hernies inguinales et fémorales non étrangères chez des sujets au-dessus de 20 ans (1017) — et on compare les résultats le sexe, la nature et la technique des interventions, de même ceux des malades levés précocement avant 1937 à

45 % des cancéreux n'ont subi que des variations insignifiantes cette période les symptômes ont subi des variations importantes et des complications pulmonaires ont été interprétées de la même façon. Pendant toute

Levée précocement chez des malades «levés précocement», qui ont été débout avant l'apparition des symptômes. On considère comme jourée après l'opération. On recommande plus court, mais alors les cas seraient peu nombreux. A notre connaissance aucun des malades a été touché

d'embolie après leur sortie du service. En comparant les malades levés tardivement à ceux levés précocement on trouve des résultats concordants dans les 3 groupes de malades. Aussi bien le chiffre des embolies que celui des complications pulmonaires baisse à env. 1/3 de ce qu'il était chez les malades levés tardivement.

La cause de ce fait on croit la trouver, en ce qui concerne les embolies, dans le maintien du tonus vaso-moteur.

Pour les complications pulmonaires on considère que la levée précoce favorise l'amplitude respiratoire du diafragme et assure un meilleur remplissage des parties inférieures des poumons. La mensuration de la capacité respiratoire des 24 malades gastrectomisés montre que la courbe spirométrique atteint des valeurs normales beaucoup plus rapidement chez les malades levés précocement, que ce qu'ont trouvés des recherches danoises et américaines chez ceux levés tardivement.

La durée de l'hospitalisation post-opératoire est réduite de 30 à 50 %

Par la diminution des complications post-opératoires et de la durée de l'hospitalisation, par le fait que les opérés éprouvent à un degré moindre la sensation d'être malades et qu'ils peuvent retrouver plus rapidement leur travail etc., la levée précoce présente des avantages tellement nombreux que la méthode devrait être adoptée par tous les chirurgiens.

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## On Bladder Tumours.

By

HARALD ABRAHAMSEN

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The bladder epithelium has a tendency to metaplasia, comparatively slight irritation may change its aspect and biological features. It is a well-known matter that the excretion of aniline or benzidine through the urine can cause papillomas or cancers as in the case of aniline dye-workers or after inhalation and make-up as in the case of painters and actors. It is also well-known that parasites — *Bilharzia* — can cause proliferation of the epithelium, and there is no doubt that bladder stones have the same effect, at any rate it is a fact that a combination of stone and tumour is no unusual occurrence.

The *pathological anatomy* presents a chequered picture. It may be difficult to differentiate between the benign forms and the malignant ones, and further it must be kept in mind that growths starting as benign, clinically as well as microscopically, later on may develop malignant characteristics. If, however, the tumour is of the typical papillomatous appearance with fringes resembling "small-leaved aquatic plants swaying in running water" (THOMSEN), and if it is pedunculated, the clinical diagnosis will be benign *epithelial tumour*, but the real criterion of this diagnosis can only be ascertained microscopically. If, on the other hand, it is a case of the warty tumour resembling a raspberry or a growth with a rampart-like projecting edge and a rugged surface on a short and broad pedicle, or if it is completely embedded in the mucous membrane, one must be on the look-out. The microscopic picture may reveal signs of malignancy at once, but in certain cases such signs cannot be discovered, and a diagnosis of benign tumour is passed. The clinical examination, however, gives rise

to a suspicion that the possibility of malignant degeneration is present, and in many cases these growths do develop into infiltrating *bladder-wall tumours*. It is then a question of *malignant papillomas*. The third main type, the *cancer*, may appear as a cauliflower-shaped rough-surfaced or diffusely infiltrating tumour, frequently with projecting limits, more or less ulcerated in the centre, at times red in consequence of hemorrhage or incrustations, or white on account of necrosis. Its surface is often reddened and edematous. Unfortunately the picture is frequently veiled by the concurrent secondary cystitis covering the tumour with fibrinous coatings and tassels making it difficult to discern the details as well as the demarcation to the inflamed bladder mucosa.

As a matter of course the clinical cystoscopic examination is of the utmost importance. It is a question of Ascertaining the site of the tumour, whether it involves the internal orifice or the ureters, whether it is pedunculated or sessile, whether there is necrosis and infiltration, whether it is single or multiple. If at all possible a specimen should be removed for biopsy in order to secure exact information as to the histological structure of the growth, before plans can be made as to the method of treatment. In our department we have therefore, especially in recent years, attached the greatest importance to the removal of such specimens for microscopic examination, and in 28 out of 39 cases of papillomas we have succeeded in establishing the microscopic diagnosis in this manner. In a few cases the tumour was too small to allow of a biopsy without grave hazards, especially prior to 1935, when the Department only had the YOUNG forceps available, which is not an ideal instrument for the removal of biopsy specimens. But in recent years it has in most cases been an easy matter to remove specimens sizable enough for histological examination by means of a rongeur or loop through the MCCARTHY resectoscope. As regards the 40 cases of cancer the diagnosis was established by microscopy in all cases, either on autopsy or by biopsy.

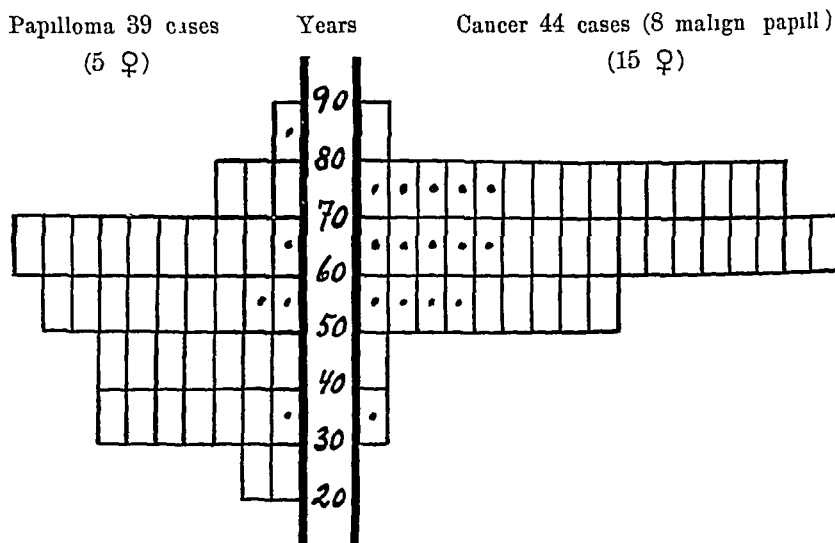
What about the *location* of the various tumours? Distinguishing between papillomas and the two kinds of cancer, it may be seen from table 1 that it is a case of 39 papillomas and 44 cancers. It appears that far the largest amount of the papillomas (24 in all) are located around the ureteral orifices, but comparatively few at the vertex (3), the bladder neck (2), and the trigone (2), whereas the cancer is more equally distributed all over the bladder. The bladder-neck, however, forms an exception, being a rare site of

Table 1

	Papill	Cancer
Bladder-neck	2	4
Trigone	2	12
Ureteral orifices	24	12
Corpus and Vertex	3	14
Multiple	8	2 (Uncertain)
	39	44 (8 malign papill)

tumours It is remarkable that the material contains 14 cancers situated in the vertex (against only 3 papillomas) which fact must be borne in mind, without however, extracting any fixed rule from the comparatively small number of cases under discussion Table 2 states age and sex As might be expected it appears that in early life papillomas are far more common than cancers, besides another well-known matter that females are inferior in number in the case of papillomas Generally it is considered that papillomas are 3—5 times more common in males than in females, in our material the ratio is 8 to 1 On the other hand the number of females increases when it is a question of cancer, in the present material 15 females out of 44 cases Judging from these small figures, a bladder tumour in a woman is likely to be malignant in a number of cases

Table 2.



The *symptomatology* is dominated by the hematuria which frequently is very capricious in its behaviour Thus papillomas may exist for years without occasioning hemorrhage A major or minor

hemorrhage may suddenly arise, dyeing the urine or appearing as hæmaturia terminalis of short or long duration, and then stopping suddenly to return perhaps years later. During this intermediate period the patient need not show any symptoms at all. The characteristic thing here is the *symptomless intervals*. The hemorrhage need not be violent, it may be so slight as to be demonstrable by microscopy only. The erythrocytes then cause an irritation of the bladder with pollakiuria which is wrongly diagnosed as cystitis. But in other cases — thus in 3 of our 39 cases — the hemorrhage has been so profuse as to fill the bladder completely with blood and clots and thus bringing the urination to a stop, so that the patients arrive at the hospital with a diagnosis of retention. The correct diagnosis can only be established after cystoscopy and evacuation of the blood clots.

Unfortunately the patient as well as the doctor often neglect a hæmaturia when it quickly stops, especially because the following period is symptomless. It must therefore be emphasized that an ascertained hæmaturia requires cystoscopy. In the case of cancer the hæmaturia is similar to that in case of papillomas, but there the appearance of other symptoms is relatively quick on account of the infiltrating growth of the tumour, reducing the capacity of the bladder and disturbing the contractions of the detrusor. Urination becomes frequent and painful, later on the pains also persist when the patient is not urinating. These symptoms are further accentuated on the appearance of the cystitis. It is then characteristic of cancer that the intervals of the benign papillomas are lacking and that the subjective as well as objective symptoms constantly increase in intensity.

The *treatment* of bladder tumours is greatly varied. Each individual tumour must be treated by the method suitable in the special case. Regard must be paid to type, location, infection, age, general health, possible metastases, and renal function. A thorough examination must be made of the condition of the kidneys, especially if the tumour has its site in the vicinity of the ureteral orifices the obstruction of which may give rise to hydro- or pyonephrosis.

The methods of treatment at our disposal may be divided into the transurethral or the suprapubic operations, radium therapy, or the latter combined with an operation.

No doubt the most important progress in the treatment were the endoscopic operations and radium therapy. Let it be said

that already in the beginning of this century YUONG and BEER designed operation cystoscopes for the implantation of radium in case of malignant tumours, by means of a forceps the radium needle was placed direct on the tumour, was left there for 1—2 hours, whereupon the cystoscope with the radium needle was removed. Later BARNEY and BARRINGER have improved the method with technical refinements. Recently MOORE has designed radium needles provided with small loops. The needles are implanted into the tumour whereupon the cystoscope is removed in order to be re-inserted after the course of 1—2 hours, a forceps is applied to the loops and the needles removed. KIRWIN uses radon seeds instead of radium needles, small emanatic gold seeds are implanted in the tumour and left there. The implantation of radium needles or radon seeds may be effected through a cystoscope as well as by cystostomy. The greater part of the tumour is often removed beforehand by means of fulguration or extirpation with a cautery knife.

In France, PASTEAU and DEGRAIS introduced radium therapy by cystostomy as far back as 1913, and this method is used especially by DARGET and LANGE who in 1935 and 1939 published their results showing a 42 % cure of cancer. In Sweden, STROMBECK advocates radium therapy which he has used 45 times on 42 patients out of 61, in case of benign papilloma (19) as well as malignant papilloma (19) and infiltrating cancer (4).

There has been some dispute as to whether to use radium needles or radon seeds. The disadvantage of the radon seeds is that the seeds are left lying and thereby may encrust and occasion stone formation. On the other hand only one cystoscopy is done and in case of cystostomy a primary closure may be applied to the bladder. The merit of the radium needle method is that they are removed in the course of 1—2 hours, the disadvantage that the cystoscope must be introduced twice and that the cystostomy cannot be closed primarily, disadvantages which, however, are not so great. A question of greater importance, however, is which of the two methods is most effective, but we lack the experience to decide. Thanks to the valuable assistance of JENS NIELSEN, Chief of the Radium Station, Department D has commanded the use of radon seeds which have been implanted partly through the cystoscope and partly by open operation. Our experience in this field is still inadequate, but in the few cases where we have radons the effect seems to be good. Unfortunately this collab-

oration has had to be discontinued, because gold for the radons are unobtainable for the present

Which method of attack should then be chosen in the individual case when the diagnosis has been established by biopsy? First the transurethral operations shall be mentioned

*Transurethral fulguration* is an easy and excellent method in case of small papillomas. The tumour is destroyed in one stage and an examination 8—10 days later reveals the site if implantation healing in contradistinction to the malignant cases where there is less tendency to heal, and where the surface furthermore is reddened and edematous, not to speak of a rapid recurrence of the tumour. In case of large papillomas where the benign character of the tumour has been established by a biopsy, fulguration is applicable, but it becomes lengthy and impracticable except in several stages. In such cases many surgeons prefer cystostomy, excision of the tumour with a cautery knife and fulguration of its base. Finally STROMBECK has treated a series of cases by further implanting radium needles. In our Department we have preferred to remove the tumour by means of a loop using the McCarthy resectoscope. We have removed the entire tumour by means of the resection loop and the pedicle and base have been fulgurated. We thus effect a *transurethral extirpation* which of course must be done with the greatest care in order to avoid lesions to the bladder wall. This operation has been applied in 28 cases, several times the resected part of the tumour has been large, up to 50 grammes, in all cases in one stage. As a rule the extirpation does not involve any difficulty, but if the tumour is located at the vertex of the bladder it can be difficult to reach with the resection loop, in that case the assistant surgeon can approach the tumour to the resectoscope by pressure upon the bladder towards the small pelvis. In one case, however, the resection proved to have been done too deep, resulting in perforation and uroplama, so that the patient succumbed in spite of cystostomy and drainage.

*Transurethral implantation of radium*. The resectoscope is an excellent remedy as long as it is question of benign papillomas. It may also be valuable in case of cancer, but as already mentioned the location plays a great part. If there is a malignant papilloma at the base of the bladder, perhaps somewhat to one side, the tumour can be removed by endoscopic resection with subsequent application of radium in one form or other. This

procedure may also be applied to the minor cauliflower-cancers or infiltrating cancers with the same location. Should the tumour on the other hand be situated further up on the bladder wall or at the vertex, it is impossible to implant radium by this route. The implantation must then be made by cystostomy.

The suprapubic cystostomy is applied in most cases of *cancer* and *large papillomas* which cannot be extirpated endovesically, especially when located at the vertex, in particular just above the internal urethral orifice. Extirpation of the papilloma may then be effected either with a cautery knife or various kinds of loops, the extirpation is thereupon combined with implantation of radium. If it is a *cancer* the bladder may be *resected*, especially if the cancer has its site at the vertex to which there is fairly easy admission. But if the tumour is located further down on the bladder wall, so that the ureter must be severed and transplanted higher up on the bladder wall, radium therapy is preferred, because after the transplantation the ureteral orifice will easily become structured which involves the danger of hydro- or pyonephrosis of the kidney in question. Mention should also be made of *varying operations*, when it is a question of multiple tumours, e. g. resection of the main tumour, and fulguration maybe with implantation of radium into the small ones.

Finally there is *cystectomy* with transplantation of the ureters to the skin or colon. This attack of course entails a very high mortality, it being mostly a question of elderly patients with a severe cystitis, frequently with a secondary renal affection too. This operation is now mostly applied in places where no radium is available (HACKENBACH, LEDERBERGER, ÅKESSON, see also PRIESTLEY and HIGGINS).

Lastly a brief survey of the *material in our department*. During the period from 1929 to 1941 39 benign papillomas and 44 cancers (hereamongst 8 malignant papillomas) have been treated. In 28 of the 39 cases of benign papilloma microscopic examination was made, 26 were extirpated transurethrally, 2 were removed by cystostomy, and the remainder were fulgurated. 6 of the 39 died — 2 at the hospital (one of embolism and one of a perforation of the bladder) and 4 later, 29 have been followed up, 4 have not, either because they themselves refused to be after-examined or else their relatives have prevented it. 10 out of the 29 had a recurrence which was treated repeatedly with intervals of months and years. The Department still tries to keep in touch with all

the patients, urges them to submit to after-examination, but often meets with uncomprehending opposition. With the utmost plainness the material proves the necessity of controlling these patients again and again. It also illustrates the fact that recurrences may be encountered even years after the operation, just as papillomas may arise in new sites in the bladder at so late a date. Our material thus contains a patient who in September 1934 was submitted to a transurethral extirpation of two large papillomas situated at the right ureteral orifice, on after-examination in 1939 the bladder was normal, but in July 1943 a minor papilloma was demonstrable at the left ureteral orifice, — a case which urges to a close control of these patients for years.

While the results may be regarded as fairly gratifying in the case of the benign papillomas it is quite a different matter in the case of *cancer*. Here the results are poor, and the reason is that in far the largest number of cases the patients come under treatment so late that any radical surgical intervention is hopeless. Out of the 44 patients with cancer 17 died in the hospital either shortly after admission or in connexion with the taking of a biopsy specimen, 9 had a cancer so extensive and were in such poor general condition that a radical operation was out of question, 4 of them had a palpable growth invading the parameters, 2 were treated with extirpation and implantation of radon seeds, the one with a splendid local effect, the very distressing, imperious, painful urination was relieved, and the tumour subsided, 6 months later, however, the patient died of metastases. In the second case the result was satisfactory, now a year has elapsed without signs of a recurrence. 3 other patients were likewise treated with radon seeds, but the disease was so far advanced that we did not cherish any hope of a favourable result, one of them died one week after the implantation of the radon seeds. In the years before 1933 6 patients were treated with transurethral resection and fulguration, they have of course all had recurrences. — In 6 cases only we have succeeded in carrying through a *resection of the bladder wall* in case of infiltrating cancer. One patient died of sepsis in connexion with the operation, 5 survived the resection (3 with transplantation of a ureter further up in the bladder) 3 of them getting recurrences or metastases and dying from 6—12 months after the operation. In one patient the tumour was situated in the region above the internal orifice, a portion of the anterior wall and the prostate were removed with resulting



stenosis of the internal orifice for which reason it became necessary to apply Pezzer's catheter through the suprapubic fistula, 2½ years after the operation this patient is still alive without signs of a recurrence. In the latter case a resection was made of the right side of the bladder with transplantation of a ureter further up on the bladder, 1 year later this patient developed a hydro-nephrosis and later a pyonephrosis necessitating a nephrectomy. After that the condition grew satisfactory and now, 3½ years after the resection he is in good health without signs of a recurrence.

The results of our treatment of bladder cancer are thus not very encouraging. It is a matter of course that an early diagnosis is of the utmost importance here as well as in case of cancer in other parts of the body. Far too often our patients have been admitted in a desolate condition with inoperable tumours, and it is worth emphasizing that not one of our 15 female patients was in a condition to allow of a radical intervention. The radical operations are not especially encouraging either, but refinements in the anesthetic methods and the sulfanilamides are sure to prove a valuable aid in cases where resection is possible, i. e. especially in case of tumours of the bladder vertex. The best aid, however, is sure to be the radium therapy, when we again have this excellent remedy available.

### Summary.

- 1 The pathological anatomy of bladder tumours is discussed
- 2 The importance of biopsy is emphasized
- 3 A survey is given of the location of the tumours as well as their distribution according to age and sex. 39 papillomas (5 females), 44 cancers (15 females)
- 4 Under the heading treatment the author discusses the transurethral operations, particularly the transurethral extirpation which has been effected in 28 cases of papilloma out of 39, the transurethral implantation of radium, cystostomy with implantation of radium, resection, especially in case of tumours of the bladder vertex, and emphasizes that radium therapy is sure to become the prevalent method of treatment in cases of cancers situated in the lower parts of the bladder
- 5 The material of Department D of the Bispebjerg Hospital is submitted

### Zusammenfassung.

- 1 Die pathologische Anatomie der Blasentumoren wird besprochen
- 2 Die Bedeutung der Biopsie wird hervorgehoben
3. Es wird eine Übersicht über die Lokalisation der Tumoren und ihre Verteilung nach Alter und Geschlecht gegeben 39 Papillome (5 Frauen), 44 Krebse (15 Frauen)
- 4 Bei der Behandlung werden die transurethralen Operationen beschrieben, besonders die transurethrale Exstirpation, die bei 28 von 39 Fällen von Papillom zur Ausführung kam, ferner die transurethrale Einlegung von Radium, die Zystostomie mit Einlegen von Radium, die Resektion, besonders bei Tumoren des Vertex, und es wird hervorgehoben, dass die Radiumbehandlung bei in den unteren Abschnitten der Blase sitzenden Krebsen sicher die vorherrschende Methode werden wird
- 5 Das Material der Abteilung D wird vorgelegt

### Résumé.

- 1 Rappel de l'anatomie pathologique des tumeurs vésicales.
- 2 Accent mis sur l'importance de la biopsie
- 3 Revue de la localisation des tumeurs et de leur répartition selon l'âge et le sexe 39 papillomes (5 femmes), 44 cancers (15 femmes)
- 4 Au chapitre du traitement les opérations transuréthrales sont mises sur le tapis, en particulier l'extirpation par les voies naturelles qui fut exécutée dans 28 des 39 cas de papillomes, puis l'introduction transuréthrale de radium, la cystostomie avec application de radium, la résection, spécialement dans les tumeurs du sommet de la vessie, et il est souligné que le traitement par le radium est certainement appelé à l'emporter dans le cancer localisé aux segments inférieurs de la vessie
- 5 Présentation du matériel de la Division D

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From the Surgical Service, Lund  
(Surgeon-in-chief Professor J P STROMBECK)

## The Surgical Treatment of Cancer of the Superior Part of the Stomach.

### Report of a Successful Cardiac Resection in a Case of Cancer of the Fornix.

By

J P STROMBECK

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Surgical treatment of cancer of the cardiac end of the stomach has already been carried out successfully in a certain number of cases. But these operations are not so common, particularly in Sweden, that a report of a single successful case cannot be considered worthy of publication. It may be that such a report would awaken and maintain interest in the surgical treatment of a form of cancer of the stomach in which, with practically no exceptions, the patients are still left to their fate, possibly with irradiation as a palliative measure.

### Case Report.

Kir klm 4808/42 The patient was a midwife of 46 years with no history of gastric trouble. In May 1942 she began to feel tired and depressed. Pernicious anemia was diagnosed at another hospital. Liver injections were prescribed. Gastro-intestinal roentgen examinations on the indication of melena were made on June 15 and 29, but nothing pathologic was found. Weber tests gave constantly positive results. Roentgen on July 8 showed a tomato-sized tumorous contrast defect in the gastric fornix next to the cardia with an irregular, ragged outline. Roentgen treatment was instituted, since the condition was considered inoperable. Dosage: A total of 11,400 r on three fields between July 10 and Nov 8. Roentgen examination on September 29 showed that the tumor, which was broadly attached to the medial wall of the stomach immediately above the cardia had decreased slightly.

in size and its outline had become more even. Repeated transfusions were given. Roentgenograms taken again on December 15 showed the tumor to be unchanged in size.

On admission to the Surgical Service in Lund on December 30, 1942, the following observations were made. The general condition was relatively good. The patient was of slight build and thin, weighing 57 kilograms. Blood chemistry: hemoglobin, 41 per cent, erythrocytes, 2,400,000, sedimentation rate, 26 mm in one hour and 64 mm in two hours. Palpation of the abdomen disclosed nothing abnormal. Weber test was two-plus.

Roentgen on January 2, 1943, revealed in the upper part of the fornix and the uppermost part of the body of the stomach posteriorly and on the side of the lesser curvature a nearly orange-sized contrast defect with an irregular, lobular outline, which was broadly attached to the wall of the stomach. This defect did not affect the cardiac end of the esophagus, through which the contrast fluid passed normally into the stomach (see figure 1). The inferior contour, however, reached 1—2 cm beneath and behind the cardia. The defect had increased in size since the examination on December 15, 1942, and was somewhat larger than at the first examination on July 8. Roentgenograms had showed a neoplastic process in the superoposteromedial part of the stomach, most probably of malignant nature.

January 4. A five hundred cubic centimeter blood transfusion was given. January 5. Hemoglobin, 54 per cent, erythrocytes, 2,800,000.

*Operation* on January 7, 1943 (STROMBECK). Resection of the cardiac end of the stomach was done under lumbar anesthesia with nitrous oxide. The operation took three hours. The incision was made below the left costal margin. In the medial part of the fundus, immediately above the cardia was found an egg-sized tumor, which was about equally developed on the anterior and posterior wall. It bulged far into the gastric lumen, but had not passed through the wall to the serosa. There was a scarcely pea-sized nodule on the anterior aspect in the lower margin of the tumor near the lesser curvature. No glands could be seen, and the stomach and lower esophagus were fully movable with the tumor. The liver and ovaries were normal, and there was no ascites. There was no doubt, however, that the tumor was malignant. The lowermost part of the esophagus was easily detached so that a finger could be passed around the abdominal part of the esophagus. The left gastric artery and the vena coronaria ventriculi were then ligated. The superior part of the stomach was next drawn out with forceps, a rubber tube placed around the cardia was useful in this connection. The greater curvature was thereupon exposed and the stomach divided approximately at the angulus. The distal end was partly closed, leaving a four- to five-centimeter long opening somewhat nearer the lesser curvature to serve as an anastomosis to the esophagus. A strong right-angled clamp was applied just above the cardia. The superior part of the stomach was turned upward and the cardiac region drawn forward. Interrupted silk sutures were made from the stump to the posterior aspect of the esophagus above the clamp, they were left untied for the



Fig 1

STROMBECK Cancer of the Superior Part of the Stomach



Fig 2

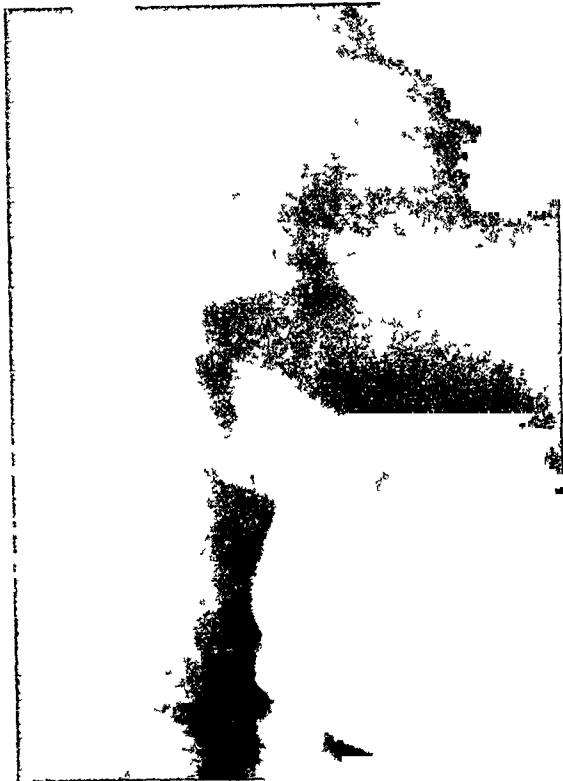


Fig 3

time being. An incision through to the esophageal lumen was then made just oral to the forceps about two centimeters above the cardia. Another row of silk sutures was made through the whole wall of the esophagus and the stomach. The first row of stitches in the serosa and then the last were now tied. The anterior wall of the esophagus was divided and two rows of silk sutures were made. There were four or five stitches in each row, both front and back. The front rows were the most difficult to finish. After about one gram of sulfathiazol had been strewn around the site of the anastomosis, the stomach was attached to the serosa-covered portion of the diaphragm on the anterior aspect. Finally the omentum was wrapped around the site of the anastomosis. A Witzel fistula was made in the canalis with the tip of the rubber tube down in the duodenum. The abdomen was closed without drainage.

The specimen was split along the lesser curvature. A broad-based, fairly soft tumor with some ulceration in the center was found. Two centimeters of the esophagus was included in the specimen. The shortest distance between the margin of the tumor and the cut margin of the esophagus was three centimeters (see figure 2). Microscopic examination revealed the gastric tumor to be a polypous adenocarcinoma, with infiltration deep down into the muscularis. The nodule on the anterior aspect of the wall of the stomach was a lymph node to which the tumor had extended. Otherwise there were no glands in the specimen. The resection margins were free from tumorous growth.

The convalescence was rather stormy with rises in temperature to nearly 40 C during the first week and with an extensive serous exudation in the left pleura. Cultures of the fluid gave no growth. The wound around the abdominal fistula suppurated rather copiously, but there was no leakage of gastric content. The patient was not allowed to drink until fourteen days after the operation. The gastric fistula was retained for seven weeks, in order to give the patient more abundant nourishment. Fluids by venoclysis and transfusions were given, and the patient was submitted to repeated sulfathiazol courses. On February 7 there was a collapse with a rise in temperature, probably due to acute cardiac insufficiency in connection with an exacerbation of a local inflammatory process under the diaphragm. The temperature gradually became subfebrile. The patient began to sit up on February 26. March 11 70 per cent, erythrocytes, 3,400,000.

Roentgen examination on March 22. The contrast fluid passed through the esophagus down into the remnant of the stomach, which was 15 cm in length. From the esophagus the medium flowed over into an almond-sized, triangular lumen, whose transition into the remnant of the stomach was marked by an elevation (fig 3). The pylorus was situated about two centimeters to the left of the midline, and the duodenal bulb was directed obliquely downward to the right. The rate of evacuation of the remnant of the stomach appeared to be normal.

On discharge on April 3 the patient weighed 44 kilograms. Deglutition was normal. Hydrochloric acid and iron preparations were prescribed.<sup>1</sup>

<sup>1</sup> On examination in Dec. 1943 symptomfree



In this case conditions were favorable for radical surgical treatment of the tumor located in the medial part of the fornix. The patient was fairly young and very thin, in addition to which the intra-abdominal portion of the esophagus was relatively long and mobile. The tumor had not extended into the neighboring tissues, nor were there any extra-ventricular metastases. Probably the line of sutures was partly insufficient, resulting in a limited inflammatory process in the adjacent tissue and an abacterial pleural exudate. The local process drained partly in the operative wound. It may be that the final healing was to be attributed to the establishment of a gastric fistula to relieve the anastomosis, as well as to the local application of sulfathiazol in the operative field. Roentgenograms a little more than ten weeks after the operation showed that the communication between the esophagus and the stomach occurred via an almond-sized, triangular space, probably delimited outwardly by the outermost row of sutures which attached the wall of the stomach to the diaphragm.

The prognosis can be considered fairly promising in this case, since the tumor was relatively differentiated (adenocarcinoma) and had not yet made any real progress outside the stomach.

The main difficulty in these high resections, in addition to the inaccessibility of the site, is the anastomosis between the stump of the esophagus and the remnant of the stomach and jejunum. Leakage from the anastomosis is the main cause of the high death rate. In the literature these questions are mainly discussed in relation to total gastrectomy. INGEBRIGTSEN in the Scandinavian literature has described two cases of palliative resection of the cardiac end of the stomach.

ROEDER's collection of 63 cases of total gastrectomy from the literature of 1897 to 1933 showed a mortality of 50 per cent. HOLST in 1942 described twelve such cases with four deaths (33 per cent), while LANDELIUS published ten cases with four deaths (40 per cent). In 1927 TROELL presented two cases of total gastrectomy, one of them successful. P. BULL made several attempts at surgical treatment, but not until 1933 did he succeed with one case. It must be agreed with HOLST that many unsuccessful cases have probably never been published, for which reason the mortality of 50 per cent found in the literature before 1933, is too low.

The secondary results of total gastrectomy for cancer with wide extension in the stomach also appear to be very depressing. In only one of HOLST's seven successful cases reported in 1942 was

the patient still alive and free from recurrences after eight years. And this was a case of polyposis without definitely established cancerous degeneration. The other six patients died of cancer within a year and a half. HOLST considered, therefore, that the present indication for total gastrectomy — extension to the whole stomach — is of little interest.

PETRÉN also claimed in 1936 in a discussion of LANDELIUS' results that it is scarcely justifiable or wise to extend the indications for total gastrectomy in cancer, since the increase in primary mortality outweighs the possible improvement in end results.

On the other hand, it must be considered more rational, as HOLST pointed out in 1942, to resort to the extensive operations — by which he meant total gastrectomy — in cancer of the corpus and fundus of the stomach, which has not yet reached the immediate neighbourhood of the cardia. HOLST did total gastrectomy, retaining the cardiac ring, without complications in four such cases, but it is too early yet to judge the final results.

In gastric tumors in the region of the cardia (fornx and upper part of the corpus), it is questionable whether *total* gastrectomy is necessary. Since the main difficulty is the anastomosis to the esophageal stump, which is devoid of serosa, it probably makes no difference to the primary mortality whether the entire stomach is removed and the anastomosis made to the jejunum or the canal is left for anastomosis purposes.

A number of follow-up examinations have shown furthermore that the absorption of nourishment is scarcely if at all impaired following total gastrectomy (TROELL, LOSELL, KARLMARK 1927, P. BULL, STANG 1935, and others). The risk of anemia is probably just as great following resection of the fundus as after total gastrectomy, if one can judge from experiments on pigs, in which it has been shown that the presence of the fundus is necessary to the development of the antipermeic principle of the stomach (PETRI, BING, NIELSEN 1941). Postoperative functional conditions, however, better correspond with physiologic conditions if the lower part of the stomach can be retained. In addition, the intervention is somewhat simpler and causes less damage to the tissues.

The decisive question in cases of high cancer must be, however, whether *total gastrectomy provides a greater possibility of freedom from recurrence than cardiac resection*. The flow of lymph from high cancers passes toward the glands in the superior part of the

gastrohepatic ligament and along the greater curvature toward the incisura cardiaca. Communications may nevertheless exist with the glands of the posterior mediastinum (GARLOCK). The fornix of the stomach is, however, a site of predilection for the relatively limited polypous or ulcerative type of cancer, usually adenocarcinoma, which is clinically well known by its localization in the greater curvature (EKER, SODERLUND). The same good late results shown by these tumors in the greater curvature when treated by partial gastric resection, in which the superior part of the stomach is left, can probably also be expected from operations on biologically similar cancers in the region of the fornix, if the inferior portion of the stomach (antrum) is left intact. The possibility of anastomoses from the lymphatic to the inferior part of the stomach cannot be excluded, but probably plays a subordinate rôle.

Several workers also claim that in operations for gastric cancer situated in the region of the cardia, the inferior portion of the stomach can be left. For example, GARLOCK in 1942 reported nine cases of carcinoma of the cardiac end of the stomach, operated upon with a left transthoracic, transdiaphragmatic resection with intrathoracic esophagogastrostomy. Of the five patients who survived, one died one and a half years later, and four were still alive with no signs of metastasis 18, 17, 8 and 7 months after the operation. The primary mortality was four cases, or 44 per cent.

I have nothing to contribute to the question whether gastric cancer near the cardia should be approached transpleurally or abdominally. It would seem, however, that the good results achieved by GARLOCK in particular should encourage increased use of the transpleural method. It appears, especially from the Anglo-Saxon literature, that it is generally agreed at the present time that the operation of choice for cancer of the lower esophagus and cardiac end of the stomach is the transpleural resection (GARLOCK). The resection will be more radical upwards and permit of a less tension on the anastomosis if the stomach is attached high up to strips of the diaphragm, undoubtedly an advantage in many cases. This method requires an expert in thoracic surgery. As in many other branches of cancer surgery, a centralization of the cases of high gastric cancer is absolutely necessary if better results are to be achieved. Another prerequisite is obviously early diagnosis of the condition. In a roentgenologic study of 300 cases of gastric cancer, STENSTROM found cancer of the fornix in 13 per cent.

That this frequency is minimal is suggested by statistics prepared by VERSÉ, quoted by KONJETZNY, in which the growth was situated in the fundus (foiñix) in three, or 25 per cent, of twelve cases of cancer discovered accidentally at autopsy

### Summary.

Cardiac resection was performed for polypous adenocarcinoma in the fornix of the stomach in a 46-year-old woman. Sulfathiazol administered locally and after the operation, as well as a relieving gastrostomy were considered to have played a part in the healing of the transabdominal anastomosis between the esophagus and the antrum Under favourable conditions, as in the case described, the abdominal approach is considered practicable A transpleural-transdiaphragmatic method is probably preferable in the majority of cases, however Presumably most cases of cancer of the fornix are not diagnosed at a stage favorable for operation The need for centralization and for early diagnosis is emphasized

### Zusammenfassung.

An einer 46-jährigen Frau ist wegen eines polyposen Adenokarzinoms im Fornix ventriculi eine Kardiaresektion vorgenommen worden Ortlich und postoperativ verwendetem Sulfathiazol sowie entlastender Gastrostomie wird Bedeutung für die Heilung der transabdominal angelegten Anastomose zwischen Ösophagus und Antrum zugeschrieben Unter günstigen Umständen — wie in dem mitgeteilten Falle — ist der abdominale Weg als verwendbar anzusehen In der Mehrzahl der Fälle dürfte jedoch ein transpleural-transdiaphragmatisches Vorgehen vorzuziehen sein Wahrscheinlich bleibt die Mehrzahl der Fornixkrebse auf dem für die Behandlung günstigen Stadium noch immer unentdeckt Die Notwendigkeit einer Zentralisierung und einer frühen Diagnose wird unterstrichen

### Résumé.

Une femme de 46 ans fut opérée par résection du cardia pour un adéno-carcinome polypeux de la grosse tubérosité de l'estomac L'auteur attribue au Sulfathiazol, appliqué localement et administré

postopératoirement, ainsi qu'à la gastrostomie de décharge, un rôle dans la cicatrisation de l'anatomose établie par voie abdominale entre l'œsophage et l'antre. Dans des circonstances favorables — comme dans le cas relaté — la voie abdominale est considérée comme praticable. Il conviendrait pourtant de lui préférer dans la plupart des cas un procédé transpleural — transdiaphragmatique, Vraisemblablement la majorité des cancers de la grosse tubérosité continuent à rester non diagnostiqués au stade qui serait favorable au traitement. L'auteur souligne le besoin d'une centralisation et d'un diagnostic précoce.

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From Surgical Department I of Sahlgren's Hospital, Goteborg  
(Chief Professor SVEN JOHANSSON)

## The Cancer Dispensary of Sahlgren's Hospital.

By

SVEN JOHANSSON

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In 1925 a socio-medical service for patients suffering from malignant tumours was established at the, then, undivided surgical department of Sahlgren's Hospital. This service was arranged on much the same lines as the tuberculosis dispensaries. I have not been able to find a better name for it than cancer dispensary which, in fact, has become the official name. In *Zeitschrift für Krebsforschung* for the year 1927 I gave a short account of its purpose and organization. Since then I have not published until now any account of the service, which will soon be 20 years old. Even though the making up of the balance-sheet for these years has been in many ways disillusioning as regards the medical results gained by our cancer therapy, it has been beneficial, at any rate to me personally, on account of the stimulance it has given to continued efforts for improved results and to critical self-examination. The social side of the service may be unhesitatingly described as highly valuable and useful.

The object of the dispensary is to keep in touch both medically and socially with every cancer and sarcoma patient discharged, treated or untreated, from the Department. The medical part of the service consists in making regular follow-up examinations of the so-called radically operated cases for at least five years and of the others for the duration of their lives. Side by side with this, the best possible palliative treatment is provided for the unfortunately many incurable cases that are in need of such. The social relief work consists in providing financial and other help according to current principles. The organization is the

simplest possible *One medical officer*, who is responsible for the follow-up examinations, and *one nurse*, who carries out the rest of the work associated with the service

On being discharged from the hospital (or at the conclusion of the treatment) every patient suffering from malignant tumour, whether operated upon or not, is reported to this nurse, who has her office located at the hospital and who keeps a special record of all cases. She follows the subsequent fate of the patients by personal visits to their homes, or where this is not feasible, by correspondence, and sees that they are submitted to regular re-examinations, as a rule every three months. The social circumstances of the patients are also studied, advice is given and financial assistance rendered where necessary. The present nurse has been performing the duties of this office since 1928. The highly qualified and laborious nature of this work need scarcely be pointed out. Professional knowledge alone is not enough, a calm temperament and an optimistic view of life are needed not to lose courage in the face of the many hopeless cases. To prevent the work from becoming too depressive and one-sided the nurse in question has of recent years also taken part in the ordinary social work of the hospital.

The medical work has been carried out entirely by me personally ever since the service started. It has taken the form of weekly receptions — free of charge — of only this clientele as outpatients. As a rule, some twenty patients have been examined each time.

In 1935 I succeeded in obtaining from the town a grant of 1 000 kronor for individual relief to necessitous patients. (Previously we had got along with the aid of private charity.) This modest grant, which has been renewed every year, has been of help to a degree that can scarcely be realized. The sum, over which the nurse and I have sole control, is distributed in amounts that seldom exceed 50 kronor. It may be help for tramcar or taxi fares, purchase of medicine or suchlike, etc. when the recipient does not wish to have recourse to poor relief. Purely psychologically, these small amounts have the advantage that the task of the nurse becomes lighter when she visits the homes. She then comes not only to inquire about the patient's state of health but also to give some small financial assistance.

In comparison with the enormous sums devoted to combating cancer in general the costs of this dispensary work are extremely small. The total sum involved is 6—7 000 kronor per annum. I

venture to assert that better employed funds are scarcely conceivable

In 1937 the cancer dispensary was the recipient of an extremely welcome donation. An elementary school teacher of Gothenburg by the name of SERENA EHRENSTROM donated practically the whole of her fortune, amounting to about 225 000 kronor, to a fund for combating cancer. The fund is vested in Sahlgren's Hospital and is administered by a committee of four persons, a personal lady friend of the donor and three of the senior medical officers of Sahlgren's Hospital, a radiologist, a surgeon and a pathologist. One-half the yield of the fund is appropriated to the social activities of the dispensary, the other half to scientific purposes. At present the annual sum accruing to the dispensary is about 4 000 kronor. Thus, together with the previously mentioned sum of 1 000 kronor from Gothenburg City, the annual amount available for social purposes is about 5 000 kronor. So far, this sum has not been entirely utilized any year. Last year (1943), for instance, 3 875 kronor was assigned for this purpose.

A rough idea of the work of the dispensary can be obtained by considering some figures from the annual report for the year 1943. The visits for medical consultation were 539. The visits of the nurse to the homes of the patients numbered about 470. In addition, she was consulted at the hospital on social and other questions about 700 times. Business relating to her duties took her outside the hospital about 325 times, journeys outside Gothenburg some 20 times.

During these twenty years cases to a number of almost 4 000 have been followed. The cases for the years 1925 to 1936, inclusive, that is for a 12-year period, have been subjected to a brief statistico-medical investigation. This was carried out in the year 1940. The shortest observational period is thus four years. During this 12-year period the cases numbered about 2 000. Thanks to the continuous control it has been possible to follow up almost all the cases. The dubious cases are so few as to be statistically insignificant. Owing to the constant supervision the diagnoses may be considered to be as certain as is at all possible, even in those cases in which no patho-anatomical examination was performed. The whole material is presented in Table I.

It will be seen from the table that the largest groups have reference to cancer of the mammae, stomach and colon. A more detailed account of these is given later on.



Table  
1925—1936

			1925	1926	1927	1928	1929	1930	1931
1	Cancer labii		2	1	1	—	—	1	—
2	» linguae		1	1	6	1	3	3	2
3	» oris		3	2	1	1	3	2	4
4	» gland salivar		—	1	—	1	—	—	—
5	» oris		1	1	2	1	1	—	2
6	» maxillae		1	—	—	—	—	—	—
7	» pharyngis		—	—	—	1	—	—	—
8 <sup>a</sup>	» laryngis		—	—	1	2	1	—	3
9	» gland thyr		—	—	—	—	—	—	—
9	» mammae		32	37	29	36	34	34	40
10	» pulm et pleurae		—	—	—	—	—	2	1
11	» cardiae et								
12		oesophagi	9	2	10	6	9	9	7
13	» ventriculi		36	34	50	52	33	37	42
14	» intest tenuis		3	1	—	—	—	—	—
15	» crassi		16	10	12	14	21	14	23
16	» recti		12	11	10	15	23	9	8
17	» loc non descr		1	—	—	—	—	—	—
18	» hepatis		2	3	—	1	—	4	—
19	» vesicae felleae		1	4	3	2	2	—	3
20	» pancreatis		—	2	5	2	2	1	2
21	» abdom orig in		—	1	—	—	2	2	1
	cert		—	—	—	—	—	—	—
22	Tumor renis		6	3	8	2	6	5	5
23	Cancer vesicae urinae		4	9	5	1	4	3	5
24a	» prostatae		2	6	3	5	4	9	5
24b	» uteri		—	—	—	—	—	—	—
25a	» penis		1	—	1	—	1	3	—
25b	» ovarii		7	—	1	3	4	6	3
26a	» testis		—	3	—	2	1	—	1
26b	» vaginae (vulvae)		2	2	1	3	—	1	1
27	» cutis		7	1	3	1	1	4	3
28	» aliorum organo		—	2	—	—	—	—	1
	rum		—	—	—	—	—	—	—
	Sarcoma		21	18	18	15	12	17	19
			170	155	170	167	167	166	181

Annual mean

I

= 12 Years

1932	1933	1934	1935	1936	Total	Not radically operated on	
—	—	—	1	—	6	0	
1	—	—	—	2	20	0	
2	1	1	—	2	22	6	
—	—	1	—	—	3	0	
—	—	—	—	—	8	2	
—	—	—	—	—	1	1	
—	—	—	—	—	1	1	
2	—	4	1	—	14	9	Not really radically treated 2 living after 6 years
27	24	33	46	45	417	62	
1	1	—	—	1	6	6	
12	5	6	6	8	89	89	{ 57 fistulae Mean survival period 2½ mo One had survived 2 years
44	40	49	53	45	515	357	
1	—	—	—	1	6	4	
14	24	17	20	24	209	119	
15	14	15	7	12	151	83	Of those surviving more than 1 mo 33 % are living after 5 years One pat 19 years
—	—	—	—	—	1	1	
3	2	—	1	1	17	17	
2	3	3	2	9	34	34	One pat 20 years
1	7	2	8	3	35	35	
3	1	2	2	—	14	14	
6	4	6	10	6	67	30	Of those surviving more than 1 mo 23 % are living after 3 years
5	3	3	4	1	47	30	5 were living after 3 years, 2 after 8 and 9 years res- pectively
5	6	8	8	12	73	60	2 living after 7 and 9 years resp One pat was 39 years None really radically operated upon
—	—	—	—	—	—	—	
—	3	—	—	1	10	1	
7	14	2	10	6	63	38	Of those surviving more than 1 mo 50 % were living after 5 years
1	2	3	1	1	15	5	
—	—	—	1	1	12	0	
3	4	—	1	—	28	2	
—	—	—	2	1	6	6	
13	10	11	13	15	182	67	Of 115 operated upon, 51 (= 44 %) are living after 4—15 years
168	168	166	197	197	2072	1079	
number = 173						= 51%	

Table II

*Cancer mammae*

1925—1936 = 12 years

Total No of cases 417	So called radically operated on 355 cases	Partially op on 30 cases	Inoperable 32 cases
of which 4 males	Mean age 52 years		(1 refused op)
Double 25 cases	Max » 81 »		
(of which 4 inop)	Min » 27 »		
Mean per year about 35'	Died within 1 mo 10 (= 2.8 %)	Died within 1st year 13 (43 %)	Died within 1st year 25 (= 80 %)
	Died within 1 year 68 (= 19 %)		
	Died of cancer after 6—10 years 22		
	Living	Living	Living
	After 3 years 148 (= 44 %)	After 5 years 6	After 3 years 2 (74 & 75 years resp)
	After 5 years 110 (= 35 %)	After 6 years 3 free from relapse	(died of cancer)
	After 6—15 years 64 + 51 (with observ time over 3 but un der 6 years)	After 10 years 2 free from relapse	After 7 years 1

Concerning the main table (Table I) the following comments may be made. So-called radical operation has not been possible in more than approximately half of the cases (about 49 %). In certain groups, e. g. cancer of the lungs, oesophagus, gall-bladder, liver, pancreas and prostate, the large number of inoperable cases is easily explained. More remarkable — and regrettable — is the large number of cases of mammary cancer (14 %), gastric cancer (69 %) and intestinal cancer (56 %) which even on admission to the hospital were so far advanced that a radical operation was excluded.

The results obtained from the treatment of the mammary cancers are indicated in Table II.

The surgical treatment has in most instances been combined with irradiation (X-rays and radium). During the last few years both pre- and post-operative ray therapy have been used in practically every case. The figures are too small to admit of definite conclusions being drawn as to the value of consistently applied pre- and post-operative ray therapy. My general impression is, however, that the results have improved with increased use of this form of therapy.

Table III.

*Cancer ventriculi*

1925—1936 = 12 years

Total number 515 cases	So called radically operated on 158 cases (= 30%)	Partially op on 86 cases (= 17 %)	Inoperable 271 cases (52 = %)
298 males, 217 fe- males (= 58 %) (= 42 %)	Max age 74 years Min » 31 » Mean » 56 »	Max age 83 years Min » 35 » Mean » 68 »	Max age 87 years Min » 20 » Mean » 60 »
Mean per year about 43 cases	Mean cases per year about 13	Mean cases per year about 7	Mean cases per year about 23
Ratio accord to Nystrom 26 17 = 60 %, 40 % resp	Over 60 years 66 (= 42 %) Over 70 years 10 (= 6 %)	<i>Surviving</i> after 1 year 5 2 years 3 4 years 1 (75 1 years old)	<i>Surviving</i> after 1 year 20 2 years 2 (3 patients re- fused op)
	<i>Died within month</i> 62 (= 44 %)		
	<i>Surviving</i>		
	After 3 years 36 (= 38 % of those surviving first month)		
	After 5 years 25 (= 26 % of those surviving first month)		
	After 6—15 years 19 (1 of these had relapse after 10 years, 3 with observ time over 5 years but under 6 years)		

This statistical study, like many others, shows that the 5-year limit is not a reliable basis from which to judge the final results

Table III collocates 515 cases of cancer of the stomach. As already pointed out, the great number of inoperable cases is remarkable. With regard to the cases submitted to radical operation it will be noticed that the mortality figure for the first post-operative month is very high (44 %). The majority of these cases are to be classed as post-operative deaths. During recent years, however, the primary mortality has fallen a little. After five years about 25 % were still living among those who had survived the first post-operative month.

The cancer coli cases (Table IV) also show a high primary mortality. Among those surviving the first month after the operation there is a considerably higher freedom from recurrence than among patients suffering from cancer of the stomach. Indeed, it is even higher than in mammary cancer.

Rectal cancer showed a freedom from relapse after five years of 50 % among those surviving the first post-operative month. The sarcoma cases form a very mixed group, and the figure 44 % for freedom from relapse after five years among those operated upon does not tell much in the absence of an analysis of the different forms.

Table IV.

*Cancer coli*

1926—1932 = 12 years

Total number 209 cases		So called radically operated on 90 cases (= 43 %)	Palliatively op on 76 cases (= 36 %)	Inoperable 43 cases (= 20 %)
Males (=51%)	Females (=49%)	Max age 78 years Min » 16 » Mean 58 » Mean cases per year about 7 Over 60 years 45 (= 50 %) Over 70 years 14 (= 15 %) Died within 1 month 33 (= 36 %) Died of cancer after 10 years 2 <i>Surviving</i> After 4 years 31 (= 54 % of those surviving first month) After 5 years 22 (= 40 % of those surviving first month) After 6—15 years 18 + 3 with observ time over 3 but under 6 years)	Max age 84 years Min » 31 » Mean 65 » Meancasesperyear about 6 <i>Surviving</i> after 1 year 3	Max age 88 years Min » 27 » Mean 64 » Meancasesperyear about 4 <i>Surviving</i> after 1 year 3 2 years 1

In connexion with the statistical material presented here I shall endeavour in all simplicity to take up the question of the means by which better results can be attained in the fight against malignant tumours *within the scope of the forms of therapy at present available to us*, viz surgical and radiation treatment

In view of the many inoperable cases the first question to be considered is how an earlier diagnosis can be reached. Respecting cancer of the breast there is no doubt that cases now come under treatment considerably earlier than only a decade ago. It seems to me that the explanation of this lies partly in increased enlightenment (lectures, popular literature, etc.) and partly in the greater membership of sick-clubs with the greater facility this implies of seeking medical advice.

Gastric and intestinal cancer is a sad chapter. A more frequent recourse to X-ray examination when even relatively mild gastric or intestinal symptoms present themselves cannot be too strongly stressed. Here, our hopes for the discovery of early cases are more especially attached to the interested co-operation of the general practitioner. A cancer may be concealed behind relatively mild stomach symptoms. On the least suspicion that a gastrically located "ulcer" may be of cancerous nature operation ought to be

recommended, and in such cases the surgeon ought not to hesitate to perform a really radical resection. Practitioners must also contribute by seeing that intestinal troubles of various kinds as well as intestinal haemorrhages are not dismissed as colitis or haemorrhoids unless a proper X-ray examination has given support for doing so.

With reference to the *treatment*, I have become more and more convinced that pre- and post-operative irradiation, consistently carried out in *all* cases, will improve the prognosis of mammary cancer to a not insignificant degree. We ought to be able to count upon at least 50 % definitive cures.

In gastric and intestinal cancers — the groups that along with mammary cancer, on account of their frequency, more especially afford surgical interest — ray therapy seems at present to be of little value.

The chief objective here should be to improve the primary results of the operation.

The earlier the cases come under treatment the better are the primary operative results. But under all circumstances cancer patients are delicate subjects for operation. A minute pre- and post-operative treatment is here of quite special need. The powers of resistance of the body ought to be fortified in every way. In all cases in which it can be done a not overshort preparatory time in the department is undoubtedly of benefit.

Blood transfusion as a *preparatory* measure, even in cases of relatively slight anaemia, ought in my opinion to be employed more than hitherto. The form of anaesthesia should be the most lenient possible (spinal, evipan, nitrous-oxide gas). Intravenous drip and blood transfusion after the operation may be recommended. Early rising (preferably no confinement to bed on the days immediately preceding operation) is advisable as a prophylactic measure against thrombosis. Sulphonamide preparations should be tried locally, enterally (before operations on colon and rectum), and parenterally. I consider that I have had good aid from such especially in operations for intestinal cancer.

The figures adduced for the late results in cases of gastric and intestinal cancer that have successfully tided over the primary risk of the operation are in reality so encouraging that they ought to stimulate us to more zealous efforts to obtain better operative results. Actually, the struggle is not so hopeless as it might many times be thought.

What has been stated here concerning mammary, gastric and intestinal cancer also applies *mutatis mutandis* to other forms of cancer

That cancer of the lungs should be treated in special departments need only be mentioned here in passing This procedure would seem to be self-evident

I will conclude this short account of the work of the cancer dispensary at Sahlgren's Hospital with the question with which I ended my short paper in *Zeitschrift für Krebsforschung* almost twenty years ago "For combating tuberculosis dispensary care is spread all over the world Is it not time to make an effort to institute something similar in the struggle against the malignant tumours?"

### Summary.

In 1925, on the initiative of the present writer a socio-medical service for patients suffering from malignant tumours was established at the Surgical Department of Sahlgren's Hospital It was given the name of Sahlgren's Hospital Cancer Dispensary Its object is to keep in touch both medically and socially with every cancer and sarcoma patient discharged from the Department The medical part of the work consists of regular follow-up examinations of all cases about once every three months, for at least five years in the case of those "radically" operated upon, for the rest of their lives in the case of the other patients The social part consists in giving financial and other aid where such is needed

*One medical officer* — the writer — and *one nurse*, called the Curator, have so far been able to manage all the work of this service There is now a sum of about 5 000 kronor per year at the disposal of the Dispensary for its social activities The greater portion of this sum is derived as interest from a cancer fund founded in 1937 under the will of a teacher of Gothenburg named SERENA EHRENSTROM

The number of cases reported to the Dispensary during the past twenty years is about 4 000

The cases taken charge of during the 12-year period 1925—1936 (about 2 000) have been subjected to a medico-statistical treatment and the results tabulated

Among the more noteworthy results reference may be made to the following

Almost half (49 %) of the total number of cases were already radically inoperable on being admitted to the hospital. Of the patients with gastric cancer, 69 % were inoperable or only palliatively operable. The corresponding figures for intestinal and mammary cancers were 56 % and 14 % respectively. The results of treatment for these three important and large groups are furnished in Tables II, III and IV.

The importance is stressed of co-operation with the general practitioner in order to secure an earlier treatment of patients suffering from malignant tumours.

Stress is also laid on the value of careful pre- and post-operative treatment. Attention is more especially drawn to blood transfusions and intravenous drip before, during and after the operations, lenitive anaesthesia, sulphonamide preparations, especially in cancer of the intestines, as aids likely to improve the primary operative results. Intimate collaboration with the radiological department is urged. Finally, it is asked whether it is not time for a more general establishment of cancer dispensaries.

### Zusammenfassung.

Im Jahre 1925 wurde auf Verfs Anregung hin in der chirurgischen Klinik des Sahlgren'schen Krankenhauses eine sozial-medizinische Beratungsstelle für an malignen Geschwulsten leidende Kranke eingerichtet. Sie wurde Karzinomfürsorge des Sahlgren'schen Krankenhauses genannt. Ihre Aufgabe ist ärztliche und soziale Überwachung aller aus der Klinik entlassenen Karzinom- und Sarkompatienten. Der ärztliche Teil der Tätigkeit besteht in regelmässiger Nachuntersuchung (etwa jeden 3 Monat) aller »radikal«-operierten Kranken mindestens fünf Jahre lang und aller anderen Kranken so lange sie am Leben sind. Der soziale Teil besteht in wirtschaftlicher und anderweitiger Hilfe, wo diese erforderlich ist.

*Ein Arzt* — Verf — und *eine Krankenschwester*, Kurator genannt, haben bisher die Beratungsstelle besorgen können. Zur Verfügung hat die Fürsorge jetzt etwa 5,000 Kronen jährlich für die soziale Hilfeleistung. Der grösste Teil dieser Summe besteht aus Zinsen eines Krebsfonds, der 1937 durch Testament von einer gotenburger Lehrerin namens SERENA EHRENSTROM geschenkt wurde.



Die Zahl der bei der Fursorge angemeldeten Falle betrug in den verflossenen etwa 20 Jahren ungefahr 4,000

Eine arztlich-statistische Bearbeitung der Falle aus der 12jahrigen Zeitspanne 1925—1936 wird in Tabellenform vorgelegt Die Anzahl Falle betrug etwa 2,000

Unter bemerkenswerteren Resultaten sei erwahnt

Fast die Halfte (49 %) der gesamten Falle waren schon bei der Aufnahme ins Krankenhaus nicht mehr radikaloperabel Von den Kranken mit Magenkrebs waren 69 % inoperabel oder doch nur palliativ operabel Die entsprechende Zahl fur Darmkrebs und Brustkrebs war 56 % und 14 % Inbezug auf die Ergebnisse der Behandlung dieser drei wichtigen und grossen Gruppen sei auf die Tabellen II, III und IV verwiesen

Verf betont die Wichtigkeit der Zusammenarbeit mit den Allgemeinpraktikern, um an malignen Geschwulsten leidende Kranke fruher der Behandlung zuzufuhren

Ferner wird die Wichtigkeit sorgfaltiger pra- und postoperativer Behandlung hervorgehoben Bluttransfusionen und intravenose Dauerinfusion sowohl vor als auch wahrend und nach den Operationen, schonende Narkose, Sulfonamidpraparate, besonders bei Darmkrebs werden als zur Verbesserung der primaren Operationsergebnisse besonders geeignet hervorgehoben Enge Zusammenarbeit mit einer radiologischen Abteilung Schliesslich stellt Verf die Frage, ob es nicht Zeit ist, mehr allgemein Karzinomfursorgen einzurichten

### Résumé.

En 1925 fut ouvert à la Division chirurgicale de l'Hôpital Sahlgren, sur l'initiative de l'auteur, un bureau médico-social pour les malades souffrant de tumeurs malignes On l'appelle le Dispensaire du Cancer de l'Hôpital Sahlgren Sa tâche est de surveiller des points de vue médical et social tout patient atteint de cancer ou de sarcome qui a quitté le service Le côté médical de cette activité consiste à réexaminer régulièrement, environ chaque trimestre, tous les sujets ayant subi une opération «radicale», et cela pendant au moins cinq ans, quant aux autres, on les suit aussi longtemps qu'ils sont en vie Le côté social se traduit par une aide économique ou autre lorsque le besoin s'en fait sentir

Un médecin — à savoir, l'auteur — et une infirmière, appelée curatrice, ont tout seuls, jusqu'ici, pu assurer la marche de l'insti-

tution Elle dispose actuellement d'environ 5,000 couronnes par an pour son activité sociale La majeure partie de cette somme est représentée par les intérêts d'un «fonds du cancer», légué par testament par une institutrice de Gothenbourg du nom de SERENA EHRENSTROM

Le nombre des cas annoncés au bureau s'élève pour les quelque 20 dernières années à environ 4,000

Une étude médico-statistique des cas de la période de 12 années allant de 1925 à 1936 est présentée sous forme de tableaux Le nombre de ces cas est d'environ 2,000

Parmi les résultats particulièrement dignes d'être notés il faut relever les suivants

Presque la moitié (49 %) de la totalité des cas n'étaient plus justiciables d'une opération radicale lors de leur admission à l'hôpital Parmi les malades atteints de cancer de l'estomac 65 % étaient inopérables ou ne pouvaient bénéficier que d'une intervention palliative Les chiffres correspondants pour les cancers de l'intestin et ceux du sein sont de 56 % et 14 % Pour les résultats du traitement dans ces trois grands groupes importants l'auteur renvoie aux tableaux II, III et IV

Il insiste sur l'importance de la collaboration avec les médecins praticiens en vue d'amener les malades atteints de tumeurs malignes à se soumettre plus précocement au traitement voulu

En outre il souligne le rôle important d'un traitement pré- et postopératoire soigneux L'emploi des transfusions sanguines et du goutte-à-goutte intraveineux, tant avant que pendant et après l'opération, le choix d'une narcose peu éprouvante, l'utilisation des sulfamidés, surtout dans les cancers intestinaux, sont mis en vedette comme des facteurs susceptibles d'améliorer les résultats opératoires immédiats Une collaboration étroite avec le Service Radiologique est indispensable Pour finir l'auteur se demande si le moment ne serait pas venu de généraliser l'organisation des dispensaires du cancer

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## Wie gestaltet sich das fernere Schicksal einer Arthroplastik an der Hüfte?

Von

F LANGENSKIÖLD

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Der Gedanke, ein versteiftes Gelenk durch eine Operation wieder beweglich zu machen, ist sehr verlockend, und die ersten Berichte der Bahnbrecher auf diesem Gebiete waren sehr ermutigend. Von den von PAYR, LEXER, FALTIN, HYBBINETTE u. a. veröffentlichten schonen Erfolgen dazu bewegt habe auch ich seit 1926 eine Anzahl von Arthroplastiken ausgeführt. Die unmittelbaren Erfolge waren auch in vielen von meinen Fällen befriedigend, zum Teil sogar sehr gut, so auch die Nachrichten, welche ich in den nächsten Jahren nach der Operation von den Patienten erhielt, weshalb ich mit dem Verfahren fortgesetzt habe.

Dann begannen aber die Patienten sich wieder einzustellen, und das Wiedersehen war oft sehr wenig erfreulich. Die Späterfolge waren durchgehend kummerlich und einige so schlecht, dass ich bedauern musste sie operiert zu haben, obwohl sie anfanglich als Volltreffer erschienen hatten.

Diese Erfahrung hat mich veranlasst, eine Nachforschung über das Schicksal der von mir ausgeführten oder in meiner Beobachtung gestandenen Arthroplastikfälle zu veranstalten. Leider ist die jetzige Zeit für eine solche Untersuchung nicht besonders geeignet. Die Patienten sind schwer wiederzufinden und die gefundenen können sich nicht zur Nachuntersuchung einstellen. Die Angaben sind deshalb meistens etwas veraltet und hatten selbstverständlich durch neuere Nachuntersuchungen ergänzt werden sollen. Da sie aber vielleicht auch so wie sie sind lehrreich sein können habe ich mich zur Veröffentlichung meiner Erfahrungen entschlossen.

Die Literatur, deren Ermittlung nötig gewesen wäre zu einer gründlichen Behandlung der Frage sowie um meine Erfolge bzw. Misserfolge mit denen anderer Chirurgen vergleichen zu können, ist mir leider zur Zeit nicht zugänglich. Sofern ich habe finden können sind aber Mitteilungen über wirkliche Späterfolge nach Arthroplastiken recht spärlich. Ausser den Mitteilungen von FALTIN und HYBBINETTE habe ich nur eine Mitteilung von CAMPBELL benutzen können.

Mit Arthroplastik bezeichne ich hier nicht die von Lexer vorgeschlagene und auch ausgeführte freie Transplantation eines ganzen Gelenkes, was MÜLLER allein als Arthroplastik gelten lassen will, sondern eine Operation, durch die ein versteiftes Gelenk nach Umformung der Gelenkenden und Einlegen von Weichteilen wieder beweglich gemacht wird, was MÜLLER Arthrolyse nennt. Ich glaube dabei dem allgemeineren medizinischen Sprachgebrauch gefolgt zu haben.

Bei den Operationen habe ich mich zum Teil zu der von PAYR angegebenen Technik gehalten, also nach gehöriger Umformung der Gelenkenden das eine von diesen mit frei transplantierte Faszie aus dem Oberschenkel bekleidet. Bei Operationen an der Hüfte habe ich jedoch gleich oft nach MURPHY einen gestielten Muskel- oder Faszienlappen eingelegt. Die knöchernen Anchylosen habe ich mit einem löffelförmigen Meißel gelöst. Wo keine völlige knöcherne Anchylose vorgelegen hat, habe ich alles Knoorpelgewebe entfernt. Auch habe ich immer die Krümmung des konvexen Knochenteiles mit kleinerem Radius als den konkaven geformt. In vielen Fällen bin ich genötigt gewesen den ganzen Schenkelkopf und oft auch beträchtliche Teile des Halses zu entfernen, um die Stellung korrigieren zu können. In diesen Fällen kann man ja nicht von einer wahren Arthroplastik reden, ich habe sie auch arthroplastische Resektionen genannt. Den Zugang zum Hüftgelenk habe ich mir immer durch den lexerschen nach unten konvexen Lappenschnitt mit Durchsägung des Trochanter major und dessen Aufklappung nebst den daran inserierenden Muskeln bereitet.

Im Anschluss an die Operation ist immer ein Streckverband angelegt worden, bisweilen dazu noch eine Gipschase über zehn Tage. Nach dieser Zeit ist mit Bewegungsübungen begonnen.

Mein ganzes Material besteht aus 24 Fällen, von denen 14 das Hüftgelenk, 7 das Kniegelenk, 2 das Ellbogengelenk und 1 das

Kiefergelenk betreffen Im Folgenden werden nur die Hüftgelenke behandelt

Das die Hüftgelenke doppelt so zahlreich sind, wie die Kniegelenke hängt von mehreren Umständen ab Erstens bildet eine Hüftanchylose in schlechter Stellung ein grösseres Ubel als eine Versteifung irgend eines anderen Gelenkes, mit Ausnahme der seltenen Kiefergelenksanchylosen, zweitens gehört diese Lokalisation zu den häufigsten und drittens ist die Neubildung eines Kugelgelenkes eine verhältnismässig einfache Sache im Vergleich mit einem Knie- oder Ellenbogengelenk, wo immer das Schlottergelenk droht Der Entschluss zu operieren ist deshalb bei jenen viel leichter als bei diesen

Die Indikation zur Operation bildete in drei Fällen die doppelseitigkeit des Leidens In elf Fällen handelte es sich um eine knocherne oder fibrose Anchylose in für die Funktion ungünstiger Stellung, die eine korrigierende Operation unbedingt erforderte In einem Falle hatte die Versteifung in rechtwinkliger Beugung und extremer Abduktion stattgefunden, sonst handelte es sich um verschiedene Grade von Flexion und Adduktion Einmal war bei einer Frau der Hauptgrund, weshalb sie sich operieren lassen wollte, die von dem Leiden bedingte Unfähigkeit den Geschlechtsverkehr auszuüben

Bei der Erwägung, ob nur eine Osteotomie oder eine Arthroplastik ausgeführt werden sollte habe ich mich vielfach von den persönlichen Wünschen der Patienten beeinflussen lassen, die aber auch meistens durch Rücksichten auf ihre Beschäftigung objektiv begründet waren

Die Ätiologie des die Anchylose verursachenden Leidens war nicht immer mit Sicherheit festzustellen Dreimal (Fälle 1, 2 u 3) durfte es sich um eine alte Osteomyelitis des Schenkelhalses und einmal (Fall 4) um eine solche des Darmbeins gehandelt haben In sieben Fällen (Fälle 5, 6, 7, 8, 9, 10, 11) lagen Folgezustände nach akuten Gelenkentzündungen unklarer Art vor In zwei von diesen hatte es sich wahrscheinlich um Gonorrhoe gehandelt

In zwei Fällen (12 u 13) lagen chronische Arthritiden unbekannter Ätiologie und in einem (14) eine Arthritis anchylopoetica vor, die beide Hüft-, Knie- und Fussgelenke betraf

### Anchylosen nach Osteomyelitis coli

I R K, 17 J, ♀, J n o 180/38 Erkrankte vor sieben Jahren mit Fieber und starker Anschwellung mehrerer Gelenke, von welchen



Fig 2 Fall 2 vier Wochen nach der arthroplastischen Resection  
Der Collumrest steht in der Pfanne der Trochanter major noch  
nicht knöchern angewachsen Biegung bis 140° möglich



Fig 1 Fall 2 vor der Operation Pseudarthrose im Schenkelhals  
nach Osteomyelitis Kopfrest mit dem Pfannenboden knöchern  
verwachsen

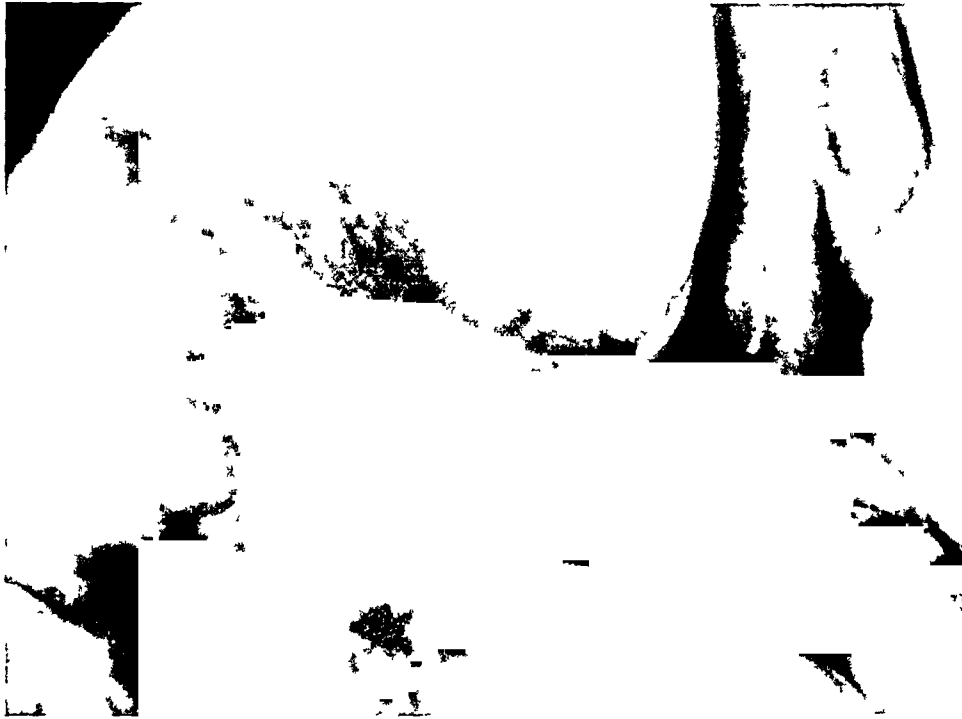


Fig. 3 Fall 1 vor der Operation Knochenerne Anchylose nach Osteomyelitis des Darmbeins, in 90° Flexion und extremer Abduktion

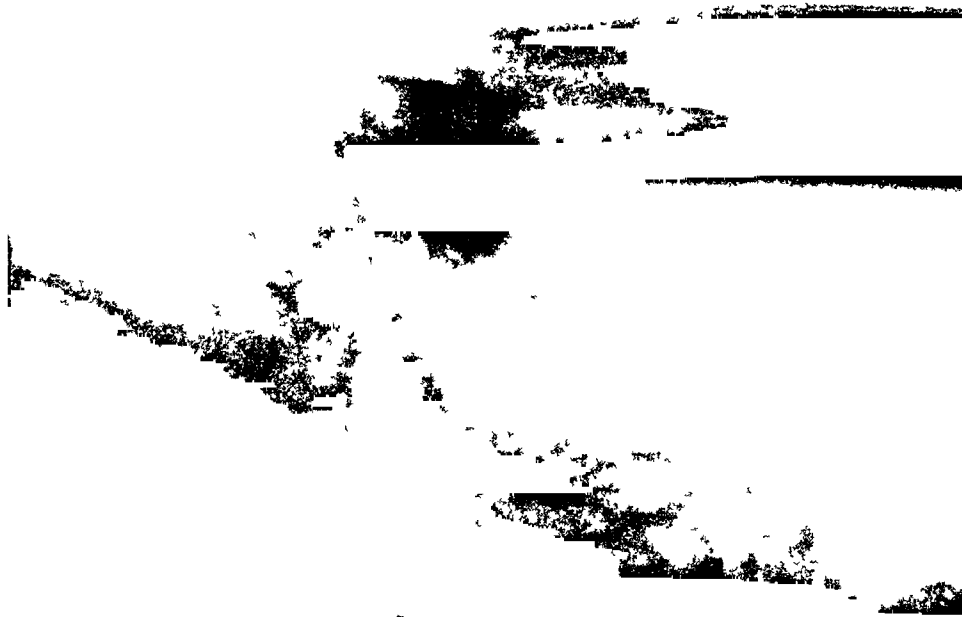


Fig. 4 Fall 1 sechs Jahre nach der arthroplastischen Resektion Luxation und Nearthrose im oberen Pfannenrand Sekundärverwachsung des Gelenkes Stabilität und Greifbarkeit ist jetzt an Unterschenkel derselben Extremität und Becken



Fig 5 Fall 7 vor der Operation Fibrose Anchylose nach akuter Arthritis Das Bild ist verkehrt kopiert

Lig 6 Fall 7 einen Monat nach der arthroplastischen Resektion





Fig. 7 Fall 8 vor der Operation. Fibrose Ankylose nach Gelenkentzündung unbekannter Art



Fig. 8 Fall 8 einen Monat nach Arthroplastik

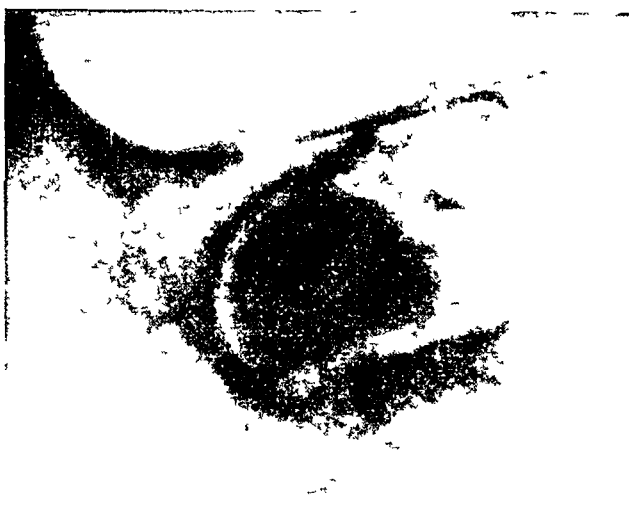


Fig. 9 Fall 8 etwa 9 Jahre nach der Arthroplastik kann die Hüfte nun bis 150° strecken und bis 110° beugen



Fig 10 Full 9 sechs Wochen nach der Arthroplastik wegen Ankylose nach akuter Arthritis



Fig 11 Fall 9 elf und ein halbes Jahr nach der Arthroplastik kann das ziemlich schmerzfreie Gelenk zwischen 180 und 135° bewegen



Fig. 12 Fall 10 kurz vor der Operation



Fig. 13 Fall 10 dreizehn Jahre nach Arthroplastik wegen Anchylose nach wahrscheinlich gonorrhoeischer Arthritis Hochgradige Arthritis deformans, Gelenk völlig unbeweglich



Fig 17

Fig 14 Fall 11 rechtes Hüftgelenk ein Jahr nach Arthroplastik  
wegen knöcherner Anchylose nach gonorrhöischer Coxitis

LANGENSKIÖLD Das fernere Schicksal einer Arthroplastik an der Hüfte



Fig 15 Fall 11 Rechtes Hüftgelenk zwölf Jahre nach Arthroplastik

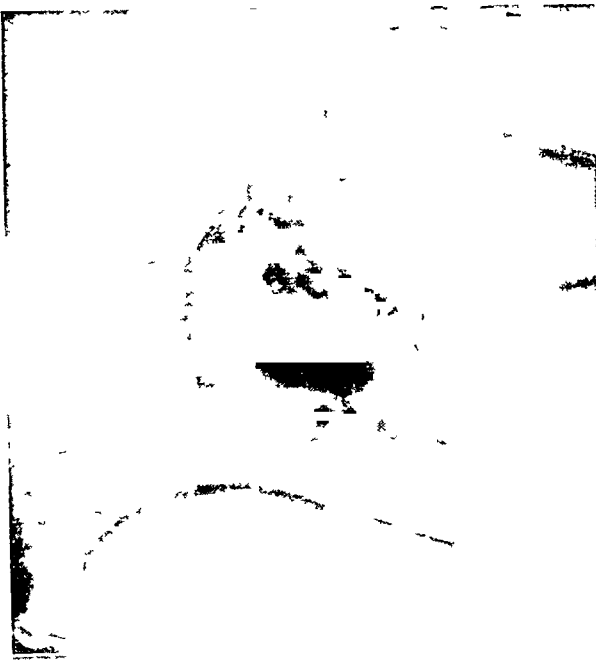


Fig 16 Fall 11 Linkes Hüftgelenk elf Jahre nach Arthroplastik

einige, u a beide Hüftgelenke und der rechte Arm sowie einige Finger, eitereten mit Ausstossung von Knochenstücken Die Eiterungen dauerten mehrere Jahre und endeten mit volliger Versteifung beider Hüftgelenke und des rechten Fussgelenkes

Aufnahme in das Diak Kr 21 VIII 37 Knocherne Anchylose beider Hüftgelenke, das rechte in 10° Abduktion und 140° Flexion, das linke in 10° Adduktion und 130° Flexion Rechtes Fussgelenk auch knochern anchylosisch in leichter Spitzfusstellung Da die rechte Hüfte noch vor einigen Tagen etwas geeitert hatte wurde die Operation auf sieben Monate verschoben Wiederaufnahme 19 III 38

21 III 38 *Arthroplastia coxae dx* Interposition eines gestielten, dünnen Muskellappens Nach der Operation recht angegriffen, im weiteren Verlauf etwas Sekretion aus den Stichkanalen, keine Eiterung 17 IV Bewegungsübungen 10 V Gehübungen

Nachuntersuchung 31 VII 42 *Keine Beweglichkeit Röntgenaufnahme zeigt wieder knocherne Anchylose*

2 A A—M, 19 J, ♀ J n o 194/36 Vor zwei Jahren erkrankte sie plötzlich mit schweren Schmerzen in der rechten Hüfte und hohem Fieber, das fünf Monate andauerte Nachher verschwanden die Schmerzen und das Fieber, die Hüfte war aber steif

Aufnahme in das Diak Kr 6 IV 36 Die linke Hüfte unbeweglich in 65° Adduktion und 125° Flexion Röntgenaufnahme 7 IV 36 (Fig 1) zeigt Pseudarthrose im Schenkelhals und knocherne Vereinigung zwischen Pfanne und Kopfstiel Wegen der schlechten Stellung wird beschlossen zu operieren und zwar, auf Drängen der Patientin, einen Versuch zu machen die Beweglichkeit wiederherzustellen

8 IV 36 *Resectio arthroplastica coxae a m* WITHMAN Die Operation bestätigt den Röntgenbefund Der Halsstumpf wird abgerundet, der Kopfstiel entfernt, die Pfanne wird mit einem gestielten Weichteillappen ausgekleidet Heilung p p 1

5 V Röntgenaufnahme (Fig 2) Aktive Beugung bis 140° Entlassen 15 IX 36 wird mitgeteilt, dass Pat radfahren und ohne Hinken gehen kann

23 VIII 44 teilt sie brieflich mit, dass sie nur nach ganz übermässigen Anstrengungen Schmerzen in der Hüfte spüre, sonst aber nicht Einen Stock hat sie während dreier Wochen nach der Operation benutzt, seit dem nicht Es besteht ein ganz kleiner Streckdefekt und das Hüftgelenk kann nicht völlig bis 90 gebeugt werden Kann unbehindert radfahren Bestellt den Ackerbau auf dem Gehoft ihres im Wehrdienst stehenden Bruders

3 A—L R, 22 J, ♀, J n o 1/42 In der Kindheit eitrige Entzündung der rechten Hüfte, nach deren diese in Adduktions- und Flexionskontraktur versteifte Wurde in einem anderen Krankenhause in üblicher Weise operiert mit Zwischenlagerung eines gestielten Lappens Aufklappen der Infektion, allmählich Nekrose und Abstossung des ganzen Schenkelkopfes

Aufnahme in das Diak Kr 19 VI 41 Nach Jahre langem Siechtum verheilten die Wunden und die Hüfte versteifte in Streckstellung und leichter Abduktion

### Anchylose nach Osteomyelitis ossis ilei

4 O F, 25 J, ♂ J n o 392/32 1926 Eiterung im linken Fuss, die zur Amputation des Unterschenkels führte 1928 Entzündung der linken Hüftgegend, Einschnitt und lange andauernde Eiterung mit Ausstossung von Knochenstücken Danach knocherne Versteifung in 90° Beugung und maximaler Abduktion (Fig 3)  
Erste Aufnahme ins Diak K<sub>1</sub> 17 IX 32 Es besteht seit drei Tagen wieder heftige Entzündung und Eiterung in der Hüfte Einschnitt 31 I 35 Erneute Krankenhausaufnahme Seit der vorigen drei mal Eiterung seit fünf Monaten aber alles geheilt 1 II 35 *Resectio anthropoplastica corae sin a m WITHMAN* Um die extreme Flexions und Abduktionsstellung korrigieren zu können zeigt es sich nicht nur den ganzen Kopf sondern auch den ganzen Schenkelhals zu entfernen Dennoch lässt sich das Ende des Schenkelknochens nicht gut in die so geschaffene und mit einem gestielten Muskellappen ausgekleidete Pfanne bringen

Der Unterschenkelstumpf wurde reamputiert und das in rechtwinkliger Kontraktur befindliche Kniegelenk geradegestellt 5 IV kann Pat die linke Hüfte aktiv bis 130° beugen  
1937 und 1941 wieder Eiterungen in der Hüfte Ausser während der akuten Schübe haben die Eiterungen aber nicht die Funktion der linken Hüfte beeinträchtigt Pat teilt 1941 mit, das er mit seiner Leichtmetallprothese auf die Jagd gehen und dabei bis 15 km laufen kann Im Gelände braucht er einen Stock, sonst nie Ein Röntgenbild (Fig 4) zeigt Luxation und Nearthrose am oberen Pfannenrand  
Nachuntersuchung 25 VIII 44 Geht mit einer neuen Holzprothese noch besser als vorher Beugt die Hüfte aktiv bis 135°, passiv bis 90° Gute Stabilität

### Anchylosen nach akuten Gelenkentzündungen unbekannten Ursprungs

5 M V, 18 J, ♀ J n o 439/37 Vor neun Jahren starke Schwellung in der rechten Hüfte, es entstand eine Fistel, die ein dünnflussiges Sekret absonderte Wurde drei Wochen in einer Kaltwasserheilanstalt behandelt, danach Versteifung der Hüfte  
Aufnahme ins Diak Kr 24 VIII 37 Die rechte Hüfte ist unbeweglich in 150° Flexion, 30° Adduktion und 30° Einwärtsrotation Das Röntgenbild zeigt knocherne Anchylose Diangt auf Operation um heilrathsfähig zu werden  
25 VIII 37 *Resectio corae anthropoplastica a m WITHMAN* Um die Stellung zu korrigieren muss der ganze Schenkelhals entfernt werden Das Obere Femurende wurde in die mit einem dünnen Muskellappen ausgekleidete Pfanne gestellt, wobei das Bein in starke Abduktion geriet Die Heilung war durch eine Hautnekrose im Wundbereich gestört, kein Fieber Die Hüfte war schon in bedeutendem Grade aktiv beweglich als Pat plötzlich Schmerzen im oberen Teil des Oberschenkels bekam Danach wurde die Hüfte immer weniger beweglich

bei der Entlassung am 4 XI 37 war sie so gut wie versteift in 10° Abduktion und ganz leichter Flexion

Drei Jahre nach der Operation erscheint sie wieder *Hufte vollg versteift, geht ganz leicht hinkend* Schnittentbindung vor zwei Jahren

6 V R, 17 J, ♂, J n o 71/37 In ganz frühem Alter Entzündung im linken Hüftgelenk, welches seitdem steif gewesen ist

Aufnahme in das Diak Kr 25 I 37 Linkes Hüftgelenk unbeweglich in 105° Flexion, 15° Adduktion und Einwärtsrotation Das Röntgenbild zeigt Deformierung des Schenkelkopfes, Pfannenwanderung Gelenkspalt eben sichtbar

29 I 37 *Resectio coxae arthroplastica a m WITHMAN* Um das Bein richtig stellen zu können muss der ganze, in der Pfanne etwas bewegliche Kopf sowie der grösste Teil des Halses entfernt werden Der Collumrest wird in die mit einem dünnen Muskellappen ausgekleidete Pfanne gestellt 23 II Röntgenaufnahme Das obere Femurende steht gut in der Pfanne Etwa 40° Abduktion 13 III entlassen Kann auf dem Rücken liegend das Bein mit gestrecktem Knie aktiv heben und die Hüfte zwischen 170° und 145° aktiv beugen Es besteht eine Abduktion von 20°

29 VIII 44 teilt er brieflich mit, dass er nach Anstrengungen etwas Schmerzen in der Hüfte habe, sonst nicht Benutzt keinen Stock Kann die Hüfte nicht ganz strecken und nur wenig beugen (lange nicht bis 90°) Kann nicht radfahren, arbeitet im Ackerbau

7 O Å, 25 J, ♂, J n o 38/39 Erkrankte vor 11 Jahren plötzlich mit hohem Fieber und Schmerzen im rechten Fussgelenk, welches operiert wurde Gleichzeitig Schmerzen im linken Hüftgelenk, welche aber ohne Operation verschwanden Seitdem beide Gelenke steif

Aufnahme in das Diak Kr 9 I 39 Die linke Hüfte steht in 105° Beugstellung und 35° Adduktion, kann weder aktiv noch passiv bewegt werden Röntgen (Fig 5) zeigt Pfannenwanderung und Subluxation Collum dick, geht ohne Grenze in den deformierten Kopf über Gelenkspalt sehr schmal

11 I 39 *Resectio coxae arthroplastica a m WITHMAN* Fibrose Anchylose Die Stellung lässt sich erst nach Entfernung des ganzen Kopfes und Schenkelhalses und Myotomie der Adduktoren korrigieren Die Pfanne wird mit einem gestielten Muskellappen ausgekleidet

Röntgenaufnahme 9 II 39 Der Collumrest steht in der Pfanne, deren oberer Rand unregelmässige Knochenauflagerung zeigt (Fig 6) 27 II 39 entlassen, kann die Hüfte bis 135° aktiv beugen

12 IV 39 teilt er mit, er habe das Gefühl als ob das Gelenk nicht richtig stehe und dass »der Muskel an der Vorderseite zu kurz sei und das Bein nicht nach hinten geführt werden könne «

11 IX 44 briefliche Mitteilung Nach Anstrengungen hat er etwas Schmerzen in der Hüfte Benutzt keinen Stock Wenn er das Hüftgelenk vollg streckt beugt sich der Rücken etwas nach vorne Kann die Hüfte nicht bis 90° beugen Arbeitet als Fischer auf dem Meer Kann radfahren



8 V M, 16 J, ♂, J n o 158/34 Hat vor  $2\frac{1}{2}$  Jahren den Rücken verletzt, wurde 6 Monate lang im Gipsbett behandelt, danach war das rechte Huftgelenk versteift!

Aufnahme in das Diak Kr 6 III 34 Das rechte Huftgelenk steht in  $150^\circ$  Beugstellung, ganz kleine Bewegungen möglich Rontgen Pfannendach ausladend, Collum plump, geht ohne Grenze in den leicht subluxierten Kopf über Gelenkspalt sehr schmal (Fig 7)

21 III 34 *Arthroplastia coxae dx* Das Huftgelenk lässt sich luxieren, der unebene Kopf und die Pfanne werden entknorpelt und der Kopf mit einer dem gleichseitigen Oberschenkel entnommenen Faszienhaube bekleidet 26 IV Rontgenaufnahme der gut gerundete Kopf steht in der Pfanne Gelenkspalt schmal 17 V entlassen Kann das Bein  $35^\circ$  ab- und adduzieren und mit dem Bein in  $90^\circ$  sitzen Bewegungen schmerzhaft

Nachtuntersuchung 8 IV 43 *Das Huftgelenk kann wieder nur bis  $150^\circ$  gestreckt und aus dieser Stellung bis  $110^\circ$  gebeugt werden Keine Schmerzen Rontgen (Fig 8) zeigt gewaltige Knochenauflagerung auf der Aussenseite des Schenkelhalses sowie freie Knochenbildung am unteren Pfannenrand Kopf schon gerundet und Gelenkspalt breiter als auf der vorigen Aufnahme (Fig 9)*

9 H L, 15 J, ♂, J n o 304/31 Vor 8 Monaten mit Schmerzen in der rechten Huft erkrankt, war eine Zeit bettlagerig, weiss nicht ob er Fieber gehabt Seitdem ist das rechte Huftgelenk allmählich steif geworden

Aufnahme ins Diak Kr 18 VIII 31 Rechtes Huftgelenk in Adduktion und Flexion, keine Bewegungen möglich Rontgen Gelenkspalt sehr schmal und unregelmässig

21 VIII 31 *Arthroplastia coxae dx* Straffe fibrose Anchylose Zwischenlagerung eines frei transplantierten Faszienlappens 5 X entlassen Hat noch nicht das Bein belastet Aktive Beweglichkeit zwischen  $160-75^\circ$  Rontgen zeigt den verkleinerten Kopf in der Pfanne Erweichungserscheinungen an der Epiphysenlinie (Fig 10)

Wiederaufnahme 31 III 43 wegen einer Rippentuberkulose Hat vor 2 Jahren eine seröse Rippenfellentzündung durchgemacht *Hufte ziemlich Schmerzfrei, kann zwischen  $180^\circ$  und  $135^\circ$  aktiv bewegt werden*

Rontgenaufnahme (Fig 11) Der verkleinerte Kopf stark sklerotisch liegt in der zu grossen Pfanne, Collum stark verkürzt An der Pfannendachecke mächtige Knochenauflagerung

### Anchylosen nach gonorrhöischer Arthritis

10 E R, 25 J, ♀, J n o 150/30 Angeblich vor zwei Monaten Verstauchung des linken Fussgelenks, bald danach heftige Schmerzen in der linken Huft, Fieber

Erste Aufnahme ins Diak Kr 3 I 29 Linke Huft gebeugt und in stärkster Auswärtsrotation, ausserst schmerzhaft so dass Pat bei jedem Bewegungsversuch laut aufschreit Obwohl keine Gonokokken nachgewiesen werden konnten wurde die Krankheit als gonorrhöische

coxitis aufgefasst und mit Milchinjektionen behandelt Streckverband 10 II mit recht gut beweglichem obwohl noch schmerzdem Gelenk entlassen

Wiederaufnahme 12 III 30 Linkes Hüftgelenk völlig unbeweglich, steht in 150° Flexion, 60° Auswärtsrotation und 20° Abduktion Geht mit einem Stock Auftreten verursacht Schmerzen Rontgenbild (Fig 12) zeigt einen schmalen, unregelmässigen Gelenkspalt Keine Deformierung

14 III 30 *Arthroplastia coxae sin* Das Gelenk muss mit dem Löffelmeissel freigemacht werden Entknoepelung von Kopf und Pfanne, Bekleidung des erstgenannten mit einer Faszienhaube

10 V 30 entlassen Das Bein steht in 30° Auswärtsrotation, kann in der Hüfte völlig gestreckt und bis 45° gebeugt werden Keine Rotation möglich

22 II 32 Teilt mit, dass es ihr wohl gehe und dass sie keine Schmerzen habe

22 XI 37 Untersuchung Hüfte in leichter Flexionskontraktur, kann nicht ganz bis 90° gebeugt werden

3 I 38 Während des letzten Monats Verschlimmerung, die Hüfte ist Schmerzhaft und ganz steif geworden

Nachuntersuchung 5 XI 43 *Keine Beweglichkeit in der linken Hüfte* Rontgenbild (Fig 14) zeigt hochgradige *Arthrosis deformans*

11 E P, 24 J, ♀, J n o 404/39 Ende Mai 1921 Gonorrhoe, gleichzeitig heftige Entzündung in beiden Hüftgelenken, welche 5 Monate dauerte und mit völliger Versteifung endete Erste Aufnahme ins Diak Kr 14 XII 26 Knocherne Anchylose in beiden Hüftgelenken, das linke in guter Stellung, das rechte in leichter Flexion, Adduktion und Auswärtsrotation

17 XII 26 *Arthroplastia coxae dx* Aufschliessung des Gelenks mit dem Löffelmeissel, Bekleidung des Schenkelkopfes mit einer Faszienhaube

23 II 27 entlassen Kann das rechte Bein aktiv bis 160°, passiv bis 45° beugen, 30° abduzieren und in normaler Ausdehnung rotieren

Wiederaufnahme 6 XII 27 Die Beweglichkeit in der rechten Hüfte hat sich weiterhin gebessert, die Kraft ist aber mangelhaft Drängt auf Operation auch der linken Hüfte

Rontgenbild der rechten Hüfte (Fig 14) zeigt eine grosse Pfanne mit Knochenauflagerungen am oberen Rand In der Pfanne steht der nicht mehr runde sondern deutlich abgeschliffene Kopf

7 XII, 27 *Arthroplastia coxae sin* Operation wie auf der rechten Seite

Wiederaufnahme 3 VIII 39 *In den letzten zwei Jahren sind Schmerzen in den Hüften aufgetreten und der Gang ist schlechter geworden Beide Hüften vollkommen insuffizient, watschelnder Gang, Lendenlordose, Trendelenburg beiderseits positiv Rontgenbilder (Fig 15 u 16) Rechts Kopffest verschwunden, Subluxation Links Collum sehr kurz, Kopffest sklerotisch, stark ausgeprägte Deformation und Subluxation*

### Anchylosen nach chronischer Arthritis

12 E T—L, 40 J, ♀, J n o 192/35 Seit 4 Jahren Schmerzen in der linken Hüfte Schleicher Beginn, allmähliche Verschlimmerung Antirheumatische Behandlung Wirkungslos Aufnahme ins Diak Kr 9 IV 35 Die linke Hüfte kann nur 30° aktiv und passiv gebeugt werden, übrige Bewegungen unmöglich Röntgenbild zeigt Abplattung des Kopfes und sehr schmalen Gelenkspalt Pat drängt auf Operation weil sie ihre landwirtschaftliche Arbeiten nicht mehr ausführen kann

10 IV 35 *Arthroplastia coxae sin* Kopf und Pfanne werden entknorpelt, der Kopf wird mit einer Faszienhaube bekleidet

3 VI 35 entlassen Kann das linke Bein mit gestrecktem Knie im Liegen bis 160° in der Hüfte heben, mit gebeugtem Knie bis 110° Belastung noch etwas Schmerzhaft

26 VIII 36 teilt sie mit, dass sie sich völlig gesund fühle und alle ihre Arbeiten, auch Melken in hockender Stellung ausführen kann Nachuntersuchung 9 IX 40 Im vorigen Sommer Sanatorienbehandlung wegen leichter Lungentuberkulose Nach einem leichten Trauma vor einigen Wochen ist das linke Knie empfindlich und geschwollen Röntgenbild zeigt starke Entkalkung und beginnende Deformierung, ob Tuberkulose oder nicht bleibt unentschieden Wegen der Schmerzen im Knie ist die Untersuchung der Hüfte schwierig, die Beweglichkeit scheint aber sehr kümmerlich zu sein Das Röntgenbild zeigt sehr starke Deformierung

13 S K, 21 J ♀, J n o 9/37 Tuberkulos belastet Vor 5 Jahren begann ihre Krankheit mit allmählich einsetzenden Schmerzen, zuerst im linken Fuss, dann in der linken Hüfte Erste Aufnahme ins Diak Kr 31 I 36 Linkes Hüftgelenk unbeweglich in 140° Flexion, 10° Adduktion und 30° Einwärtsrotation Andere Gelenke ohne Befund Röntgen Gelenkspalt schmal keine Knochendestruktion

7 II 36 *Arthroplastia coxae sin* Der Kopf kann luxiert werden, ist uneben keine Knochenherde Nach Entknorpelung von Kopf und Pfanne wird jener mit einer Faszienhaube bekleidet

17 III 36 entlassen Kann die Hüfte bis 160° aktiv und bis 155° passiv beugen

Wiederaufnahme 4 XII 36 Hat im Sommer seinen Stock fortgelassen, ist den ganzen Tag in Bewegung gewesen Beweglichkeit in der linken Hüfte sehr gering, schon bei einer Flexion über 160° bewegt sich das Becken mit Das Gelenk wird bis 9 I 37 zwölf mal in Narkose in extreme Flexionsstellung gebracht, die letzten Male kein Widerstand Tagliche Übungen Kann bei der Entlassung das Gelenk aktiv bis 105° passiv bis 90° beugen Schmerzen bei Belastung, weshalb der Gang sehr schlecht

20 IX 41 Das linke Hüftgelenk schmerzte noch 1910, dann begann es aber wieder zu versteifen und wurde gleichzeitig schmerzfrei Vor einem Jahr begannen aber die beiden Ellbogengelenke und das rechte

Huftgelenk Schmerzen zu machen. Dieses ist etwas geschwollen und so schmerzhaft, dass keine Bewegungen darin ausgeführt werden können.

*Das linke Huftgelenk ist völlig versteift in 20° Adduktion. Das Röntgenbild zeigt Sklerosierung des verkleinerten, etwas platten und unebenen Kopfes sowie Ausladen des Pfannendachwinkels. Gelenkspalt schmal. Das rechte Huftgelenk zeigt auch schwere arthritische Veränderungen.*

### Anchylosen nach Arthritis anchylopoetica

14 E P, 29 J, ♂, J n o 4/28 Vor 14 Jahren beginnende schleichende Entzündung erst in der rechten Hüfte, die als Tuberkulose behandelt wurde, dann im rechten Kniegelenk und allmählich auch im linken Hüft-, Knie- und Fussgelenk. Alle Gelenke versteiften völlig, ebenso gleichzeitig die Wirbelsäule. Sieben Jahre nach dem Beginn des Leidens erkrankten die Gelenke beider Arme. Sie wurden aber nicht wie die Beine mit Ruhigstellung sondern mit Massage und Umschlagen behandelt. Nach drei Monaten verschwanden die Schmerzen und die Gelenke blieben beweglich.

Aufnahme ins Diak Ki 31 X 37 Wirbelsäule vollkommen steif. Beide Huftgelenke in leichter Innenrotation, die Knie in Streckstellung, linkes Fussgelenk in leichter Spitzfußstellung, alle Knochen versteift.

4 XI 27 *Arthroplastia coxae et genus sin* Fieie Faszientransplantation. Nach dem recht heroischen Eingriff entstand ein bedrohlicher Schockzustand, von dem sich Pat jedoch bald erholte. 14 XI wurde mit vom Pat selbst ausgeführten passiven und aktiven Bewegungen angefangen. 2 II 28 Beweglichkeit kaum 25°. Im weiteren Verlauf versteiften die Gelenke wieder vollständig.

### Ergebnisse.

Von den 15 operierten Huftgelenken versteiften 6 wieder vollständig, 4 von ihnen (1, 3, 5 u 14) schon während des Aufenthalts im Krankenhaus, die zwei weiteren (10 u 13) vier bzw acht Jahre nach der Operation.

Alle athiologische Gruppen waren unter ihnen vertreten, in den Fällen 1 und 3 war die Ursache der Anchylose eine Osteomyelitis coli gewesen, im Falle 5 eine akute Arthritis unbekannten Ursprungs, im Falle 13 eine wahrscheinlich gonorrhoische akute Arthritis, im Falle 14 eine vom Anfang an chronische und im Falle 14 eine Arthritis anchylopoetica.

Was die Technik betrifft so war in der einen Hälfte der Fälle ein gestielter Lappen, in der anderen frei transplantierte Faszie zwischen den Knochenflächen gelagert worden.

Das Alter wechselt zwischen 17 und 29 Jahre und ist im Durch-

schnitt 22 Jahre. Bei den nicht versteiften wechselt das Alter zwischen 15 und 40 Jahre, der Durchschnitt ist  $22\frac{1}{2}$ . Wenn die einzige über 29 Jahre alte Patientin, die etwas aus dem Rahmen schlägt, nicht mitgerechnet wird, ist das durchschnittliche Alter der nicht versteiften 20 Jahre.

Es scheint somit als ob keiner der eben besprochenen Umstände irgend welche Rolle für die Wiederversteifung hatte spielen konnte. Vielmehr durfte man annehmen können, dass man sich in keinen Falle von Anchylose darauf verlassen kann, dass der die Versteifung veranlassende Prozess völlig erloschen ist sondern damit rechnen muss, dass er sich noch gelten machen und eine Wiederversteifung verursachen kann.

Wie man die Erfolge auch sonst beurteilen möge, eine Wiederversteifung nach einem Eingriff, dessen Zweck eine Beweglichkeitmachung ist, dürfte doch als klarer Misserfolg bezeichnet werden müssen.

Dasselbe muss wohl für den Fall 11 gelten, wo wegen Versteifung beider Hüften nach Goniorhoe auf beiden Seiten eine Arthroplastik ausgeführt wurde, die mit einer ausserst schweren Arthrosis deformans und einer, zwar erst nach zwölf Jahren stattfindenden, völligen Verödung beider Gelenke endete.

Es kann also festgestellt werden, dass die 15 Operationen (beide Hüften im Falle 11) 8 Misserfolge ergeben haben.

Die Klassifizierung der übrigen Fälle ist bedeutend schwerer. Ob man einen Fall als ausgezeichnet, gut oder massig bezeichnen will, ist gewissermassen Geschmack- und Temperamentsache. CAMPBELL teilt seine Erfolge ein in »ausgezeichnete, gute, Misserfolge und zweifelhafte«. Als ausgezeichnet (excellent) bezeichnet er Fälle die genügende Ausdauer, praktisch kein oder ganz unbedeutendes Hinken sowie eine Beugungsfähigkeit von 50 bis 160° und entsprechende Beweglichkeit in anderen Richtungen aufweisen.

Nach diesen Regeln beurteilt konnten vielleicht die Fälle 2, 4 und 7 als ausgezeichnet bezeichnet werden. Mir scheint es jedoch etwas zu viel zu sein, den Fall 4, der trotz seiner Subluxation und ausgeprägter Deformation sich einer staunenswerten Leistungsfähigkeit erfreut, als ausgezeichnet zu bezeichnen. Zwar ist er selbst mit dem Erfolg ausserst zufrieden, aber offenbar beurteilt er seine jetzige Lage im Lichte des entsetzlichen Zustandes vor der Operation.

Auch die Fälle 2 und 7 sind sehr zufrieden.

Es verdient hervorgehoben zu werden, dass diese drei Fälle keine wirkliche Arthroplastiken sondern arthroplastische Resektionen betrafen und das in allen dreien ein gestielter Muskellappen zur Interposition benutzt wurde

Von den übrigen 4 Fällen muss der Fall 12 als zweifelhaft bezeichnet werden, die Beurteilung des Erfolges der Operation an der Hüfte ist aber schwierig wegen der hinzugetretenen Erkrankung des Knies Die Fälle 6, 8 und 9 können als gut oder vielleicht lieber als massig bezeichnet werden

Nach der Einteilung von CAMPBELL ergibt sich also

»Ausgezeichneter« Erfolg	3 Fälle
Guter Erfolg	3 »
Misserfolge	8 »
Zweifelhafter Erfolg	1 Fall

Die Erfolge CAMPBELLS sowie auch HYBBINETTES sind bedeutend besser Dabei ist aber zu beachten, dass CAMPBELLS gute Erfolge sich auf einseitige Anchylosen beziehen, während bei den doppelseitigen die Erfolge nicht besser sind als die meinigen Ausserdem ist CAMPBELL der Ansicht, dass man schon nach zwei Jahren den schliesslichen Erfolg beurteilen kann, was ich entschieden verneinen muss Hatte ich meine Fälle schon zwei Jahre nach der Operation klassifiziert, so wäre die Zahl der als gelungene zu bezeichnenden Fälle viel grösser gewesen

CAMPBELLS Behauptung, dass die guten Fälle mit der Zeit immer besser werden, ist meines Erachtens auch nicht einwandfrei Z B mein Fall 11, der zehn Jahre lang als ausgezeichnet gelungen galt, befand sich zwei Jahre später in einem jammerlichen Zustand

Dass in einem Falle, wo die Anchylose von einer Osteomyelitis verursacht wurde, ein Aufflackern der Infektion den Erfolg vereiteln und zur Wiederversteifung führen kann, ist einleuchtend und konnte in den Kauf genommen werden, wenn die Versteifung in für die Funktion günstiger Stellung stattfindet und vor der Operation eine ungünstige Stellung bestand, sowie wenn in den nicht versteifenden Fällen der Eingriff dauernd funktionstüchtige Gelenke ergeben wurde Das ist aber, wie ich schon hervorgehoben habe, nach meiner Erfahrung nicht der Fall Allen Arthroplastik-fällen droht offenbar noch nach Jahren eine Verschlechterung, auch den nach gonorrhoeischen Anchylosen, wo man das eigentlich nicht erwartet hatte Zum Beweis dafür, dass dieses nicht nur von meinen Fällen gilt, führe ich das Röntgenbild eines Mannes vor,

der 18 Jahre fruher im Auslande von einem eben auf diesem Gebiete beruhtnten Chirurgen wegen offenbar gonorrhoeischer Anchylose operiert wurde (Fig 17)

Die in, wie ich glaube, allen Arthroplastikfallen, auch den am besten gelungenen, fruher oder spater stattfindende Verschlechterung durfte weder auf die Athiologie des ursprunglichen Leidens noch auf die angewandte Technik beruhen, sondern eine Bestatigung der Erfahrung sein, dass jede Nearthrose einmal Veranderungen anheimfallt, die fur die Arthrosis deformans charakteristisch sind und ihrem Trager alle daraus folgende Beschwerden verursacht

Aus diesen Uberlegungen kann man folgende Schlusse ziehen

1 An einem in guter Stellung versteiften Huftgelenk sollte niemals eine Arthroplastik ausgefuhrt werden

2 Wenn wegen Huftanchylose in schlechter Stellung eine Operation angezeigt ist, sollte in der Regel eine Osteotomie und keine Arthroplastik gemacht werden Nur wenn Pat, trotz Warnung, darauf drangt und auch objektive Anzeigen vorliegen, kann bei jungen Leuten, mit allem Vorbehalt, eine Arthroplastik erwogen werden

### Zusammenfassung

Es werden 14 Falle von Huftanchylose mitgeteilt, an denen 9 Arthroplastiken und 6 arthroplastische Resektionen ausgefuhrt wurden (ein Pat an beiden Huften operiert) Ursache der Anchylose war Osteomyelitis des Schenkelhalses 3, Osteomyelitis des Daimbeins 1, akute Arthritis unbekannter Ursache 5, gonorrhoeische Arthritis 2, chronische Arthritis 2 und Arthritis anchylopoetica 1 mal In 6 Fallen trat Wiederversteifung ein, 4 mal schon im Krankenhaus 1 mal nach 4 und 1 mal nach 8 Jahren Weder die Art des ursprunglichen Leidens noch die angewandte Technik oder das Alter der Patienten sind fur diesen Ausgang massgebend gewesen Die Ursache durfte das Fortbestehen der Prozesse, welche zur Anchylose gefuhrt haben sein In dem an beiden Seiten operierten Fall entwickelte sich nach 10 Jahren eine schwere Arthrosis deformans mit vollstandigem Schwund des Kopfes und Schenkelhalses auf der einen Seite und vollige Insuffizienz beider Huften Also 8 Misserfolge nach 15 Operationen

In 3 Fallen konnte der Erfolg als ausgezeichnet in 3 als gut und in 1 als zweifelhaft bezeichnet werden Auch in den gelungenen

Fallen konnten aber Zeichen einer Arthrosis deformans festgestellt werden. Verf. glaubt, dass dieses Schicksal allen Arthroplastikfällen bevorsteht, woraus er den Schluss zieht, dass man mit dieser Operation ausserordentlich zurückhaltend sein sollte.

### Summary.

Fourteen cases of ankylosis of the hip are described. Nine of them were submitted to arthroplasty and six to excision of part of the joint. In one case the operation was bilateral.

The cause of the ankylosis was osteomyelitis of the neck of the femur in three cases, osteomyelitis of the ilium in one, acute arthritis of unknown origin in five, gonococcal arthritis in two, chronic arthritis in two, and ankylopoietic arthritis in one case. The ankylosis recurred in six cases, in four of them while the patient was still hospitalized, in one after four years and in one after eight years. Neither the nature of the original complaint, the technique used, nor the age of the patient could be blamed for the recurrence in any of the cases. The cause should probably be sought in a continuation of the processes originally leading to ankylosis. In the case in which both hips were operated upon, marked arthritis deformans developed ten years after the operation and resulted in total destruction of the head and neck of the femur on one side and complete insufficiency of both hip joints. Thus eight of the fifteen operations were failures.

In three cases the results could be called excellent, in three good and in one doubtful. However, even in the successful cases signs of arthritis deformans could be detected. The author is of the opinion that this fate threatens all arthroplastic cases, and concludes that the greatest caution should be exercised in recommending this type of operation.

### Résumé

Communication de 14 cas d'ankylose de la hanche, dans lesquels on a exécuté 9 arthroplasties et 6 résections arthroplastiques (l'un des malades a été opéré des deux côtés). Voici quelles étaient les causes de l'ankylose: 3 fois une ostéomyélite du col fémoral, 1 fois une ostéomyélite de l'os iliaque, 5 fois une arthrite aiguë de nature inconnue, 2 fois une arthrite gonococcique, 2 fois une



arthrose chronique et 1 fois une arthrose ankylopoietique Dans 6 cas l'ankylose récidiva, 4 fois déjà pendant le séjour à l'hôpital, 1 fois après quatre ans et une autre après 8 ans Ni la nature de l'affection primitive, ni la technique employée, pas plus que l'âge des malades ne peuvent être rendus responsables de ce resultat Sans doute faut-il plutôt en rechercher la cause dans une persistance de l'influence des processus qui avaient abouti à l'ankylose Chez le malade opéré des deux hanches il se développa au bout de 10 ans une arthrose déformante extrêmement accentuée qui entraîna la disparition totale de la tête et du col d'un côté et une insuffisance complète des deux articulations coxo-femorales Donc il y eut huit échecs sur 15 opérations

Le resultat put être déclaré excellent dans 3 cas, bon dans 3 autres et douteux dans un Mais même dans les cas heureux on put, cependant, mettre en évidence des signes d'arthrose déformante L'auteur pense que ce soit menace toutes les arthroplasties et en conclut qu'il faut s'imposer une retenue extrême en ce qui concerne cette operation

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## Offene Pneumolyse bei Lungentuberkulose.

Von

E HEDVALL und O HULTÉN

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Die chirurgische Behandlung der Lungentuberkulose dominiert in der Gegenwart. Die Indikationen für Pneumothoraxbehandlung, ein- oder doppelseitige, sind erweitert worden. Die Abtrennung von Verwachsungen nach JACOBÆUS ist ein gewöhnlicher Eingriff, und Thorakoplastik kommt in immer grösserem Umfang zur Anwendung. Die Indikationen für Plastik werden jetzt auch mit grösserer Sicherheit gestellt, und die Operationen werden mit besserer Technik ausgeführt als früher, wodurch sich die Resultate wesentlich gebessert haben.

Die Plastik ist indes ein so verstümmelnder Eingriff, dass viele Patienten dieser Operation abgeneigt sind. Deshalb ist es der Wunsch eines jeden Lungenheilstatenarztes, dass eine weniger eingreifende, aber doch effektive Methode ausgearbeitet wurde, die man bei Kavernenfallen anwenden konnte, wenn Pneumothorax nicht angelegt werden kann oder nicht effektiv ist. MONARD's Operation ist ein Versuch in dieser Richtung, und zu derselben Gruppe von Eingriffen gehört die extrapleurale Apikolyse mit nachfolgendem Oleothorax.

Wenn man indes einen Pneumothorax anlegen kann, der aber ineffektiv ist, weil die Lunge breit flächenhaft adhärirt oder durch Verwachsungen ausgespannt ist, die aus dem einen oder anderen Grunde nicht durch Kaustik gelöst werden können, so liegt es am nächsten, den Brustkorb so breit zu eröffnen, dass die Verwachsungen mit der zugehörigen Pleura parietalis von der Brustkorbwand freigemacht werden können. Eine solche Operation, die wir im folgenden »offene Pneumolyse« nennen, ist nichts Neues. Der Eingriff wurde in einigen Fällen zu der Zeit ausgeführt,

als man sich noch nicht auf Strangdurchbiennung verstand. Seit dem Siege von JACOBÆUS' Methode hat die offene Pneumolyse an Aktualität verloren und ist nur selten angewandt worden. Die Resultate, die man mit ihr erhielt, waren auch nicht besonders hervorragend, wenigstens nicht bei den früheren Versuchen.

Offene Pneumolyse wurde erstmalig im Jahre 1909 von ROVSING vorgenommen, wobei zwei bleistiftdicke Verwachsungen durchschnitten wurden. Der Patient starb indes kurz danach an Lungenblutung und Sekundärinfektion der Pleurahöhle. JACOBÆUS & KEY haben 1916 über einen Fall berichtet, bei dem offene Pneumolyse ausgeführt worden war. Nach Eröffnung des Brustkorbes wurde eine grosse Verwachsung ( $6 \times 3$  cm) extrapleural freigemacht, während die übrigen, schmalere Verwachsungen durchtrennt wurden. Spätere Röntgenuntersuchung zeigte, dass die Lunge ziemlich stark zusammengefallen war. Indes war eine neue Verwachsung entstanden, die den vollständigen Zusammenfall der Kaverne verhinderte. Später entwickelte sich eine langwierige und beschwerliche seröse Pleuritis. Allmählich besserte sich der Zustand jedoch, aber der Patient war noch immer Bazillenträger und hatte eine röntgenologisch nachweisbare Kaverne. TOREK (1914) führte die Operation an einem Patienten mit fortgeschrittener, überwiegend linksseitiger Lungentuberkulose aus. Die linke Lunge konnte ganz freigemacht werden, doch durfte dabei eine Kaverne verletzt worden sein. Man konnte nämlich zerfallendes tuberkuloses Gewebe aus der Pleurahöhle herausholen. Ungefähr 5 Wochen nach der Operation trat der Tod ein, laut Angabe infolge schwerer Diarrhoen. Sektion wurde nicht gestattet. EDEN (1918) hatte keinen besseren Erfolg. Der kavernöse rechte Oberlappen konnte zwar freigemacht werden, aber nach einigen Tagen perforierte eine Kaverne. Trotz ergänzender chirurgischer Eingriffe starb der Patient. ULRICI (1918) konnte, ausgehend von einem kleinen Pneumothorax, eine im übrigen total adhäre Lunge freimachen. Der Patient starb jedoch später an fortschreitender Tuberkulose in Lungen und Darm. In zwei von GRAVESEN (1935) erwähnten Fällen traten postoperative Blutung und Empyem hinzu. SAUERBRUCH hat 1930 sechs Fälle mitgeteilt, bei denen ein Thermokauter zur Anwendung kam. Zwei der Fälle verliefen befriedigend, ein anderer bekam nach 3 Monaten Empyem, konnte aber gerettet werden. Bei den drei übrigen trat indes ein direkter Anschluss an die Operation eine schwere Infektion ein, die binnen 2 Tagen bzw. 3 Wochen resp. einigen Monaten zum Tode führte.

Im Gegensatz hierzu werden indes von anderer Seite ziemlich gute Erfolge mitgeteilt. MAYER (1913) nahm in einem Fall zuerst eine extrapleurale Apikolyse vor, öffnete dann vorsichtig die Pleurahöhle und löste stumpf eine grosse Anzahl Verwachsungen. Der Effekt war befriedigend. Die Lunge kollabierte gut. Der Patient erholte sich und wurde arbeitsfähig. Auch SCHOTTMÜLLER & SUDECK (1918) konnten in einem Fall durch offene Pneumolyse die Mehrzahl der fibrosen Verwachsungen freimachen, worauf die Lunge gut kollabierte und Tuberkelbazillen und

Fieber verschwanden WATSON (1924) gelang es in einem Fall, eine breite Verwachsung zu entfernen und die Lunge in befriedigender Weise zum Zusammenfall zu bringen. Die Rekonvaleszenz war indes beschwerlich. Der Zustand des Patienten war jedoch während einer Beobachtungszeit von  $3\frac{1}{2}$  Jahren ziemlich gut. DOBBRSTEIN (1925) berichtet über 5 Fälle, bei denen offene Pneumolyse stattfand. Bei vier dieser Fälle gelang der Eingriff, der fünfte dagegen starb 9 Tage nach der Operation infolge Ausbreitung des tuberkulösen Prozesses, frischer Bronchopneumonie sowie Infektion der Pleurahöhle. Die Verwachsung war nach Ansicht des Verfassers zu dick, um durchschnitten werden zu können. Als die nekrotischen Partien des Adhärenzstumpfes abgestossen wurden, gelangten Bakterien in die Pleurahöhle und riefen eine schwere hamorrhagische Pleuritis hervor. ARCHIVALD (1925) berichtet über drei erfolgreiche Fälle. ZIFGLER (1930), der nach SACHS früher die offene Strangdurchtrennung mehrmals ohne Zwischenfälle ausgeführt hat, bekam indes später in zwei Fällen komplizierende Empyeme. FELIX (1931) berichtet über 4 geglückte Fälle (von den Verwachsungen war eine »mindestens von Daumendicke«), und LILBERMEISTER (1931) über einen Fall mit doppelseitigem Pneumothorax, bei dem Dr. v. MEER mit gutem Resultat offene Pneumolyse vorgenommen hat. Endlich hat ELOESSER (1932) 4 Patienten operiert, von denen jedoch zwei Empyem bekamen.

Wie aus dieser Zusammenstellung hervorgeht, ist die offene Pneumolyse eine riskante Operation. Von den hier angeführten 33 Fällen sind nicht weniger als 8 gestorben, und weitere 7 haben im direkten Anschluss an den Eingriff Empyem bekommen. In 1 Fall war die Operation erfolglos. Die Kavene wurde zwar kleiner, konnte aber nicht zu vollständigem Zusammenfall gebracht werden. Das Sputum blieb bazillenhaltig. Nur in 17 Fällen, entsprechend ca. 50 %, wird die Operation als geglückt bezeichnet. In mehreren Fällen lagen Verwachsungen vor, die man jetzt durch Strangdurchbrennen (nach JACOBÆUS) entfernen konnte. Sicher wäre das Endresultat in mehreren Fällen ein besseres gewesen, wenn diese Methode angewandt worden wäre.

Offene Pneumolyse verdient jedoch eine neue praktische Prüfung in solchen Pneumothoraxfällen, wo die kavernöse Lunge durch Adhärenzen ausgespannt ist, die nicht durchgebrannt werden können, oder wo die Lunge flächenhaft adhäriert. Die Gefahren von Empyem und Nachblutung, die aus dem obigen Überblick ersichtlich sind, bestehen wohl noch immer, sind aber bei weitem nicht so gross wie früher. Die Thoraxchirurgie hat sich in den letzten Jahren sehr rasch entwickelt. Man hat gelernt, den Thorax breit zu öffnen, so dass man mit beiden Händen in ihm arbeiten kann. Auf diese Weise kann man einen vollen Überblick über die

Lage der Lunge und der Verwachsungen erhalten. Die Gefahr, dass die Lunge bei ihrer Ablosung verletzt wird, was zur Entwicklung von Empyem führen kann, wird hierdurch entschieden verringert. Da auch blutende Gefässe leichter beobachtet und sicherer unterbunden werden können, wenn der Thorax breit geöffnet ist, so ist die Gefahr von Nachblutung nur unbedeutend. Hierzu kommt, dass die intravenöse Narkosemethode nicht mit denselben Komplikationen verbunden ist wie die früher bei thoraxchirurgischen Eingriffen gewöhnliche Inhalationsnarkose.

Offene Pneumolyse wurde von uns in 9 Fällen vorgenommen, welche sämtlich in der Universitätsklinik in Uppsala operiert wurden (HULTÉN). Im Jahre 1942 fand der Eingriff dreimal statt, 1943 viermal und im ersten Vierteljahr 1944 zweimal. Sechs der Fälle kamen aus dem Zentralsanatorium in Uppsala (E HEDVALL), zwei aus Osteråsens Sanatorium (Chefarzt H DAHLSTEDT) und einer aus einem anderen Krankenhaus.

Die Operationen fanden in Narkotalnarkose statt. Das Narkotal wurde während der ganzen Operation kontinuierlich in Verbindung mit intravenöser Tropfinfusion von physiologischer Kochsalzlosung zugeführt, wodurch in sämtlichen Fällen eine ausgezeichnete, ruhige und leicht zu regulierende Narkose erzielt wurde, ohne dass zusätzliche örtliche Betäubung, Äther oder dgl. notwendig war.

Der Schnitt durch die Brustkorbwand muss hinreichend gross gemacht werden, so dass der Operateur ungehinderten Zugang zur Pleurakavität hat und frei mit beiden Händen arbeiten kann. Der Hautschnitt, der einige Zentimeter vom Sternum begann und einige Zentimeter vom Rückgrat endete, wurde in der Hauptsache horizontal über dem Angulus scapulae gemacht, jedoch etwas ansteigend in kcephaler Richtung zwischen der Scapula und dem Rückgrat. Nachdem der *M. latissimus dorsi* durchgeschnitten und einige der unteren Serratus-Zacken gelöst worden waren, konnte die Scapula hochgehoben werden, worauf die Rippen frei zugänglich waren. Die für die Ablosung der Verwachsungen geeignetste Rippe wurde subperiostal vom Rippenknorpel bis zum Querfortsatz entfernt. Dabei lag in der Regel die 3. oder 4. Rippe am günstigsten. Nach Durchschneiden der Pleura parietalis liegt die Pleurahöhle offen, und mit einem geeigneten Sperrhaken erweitert man die Eingangspforte hinreichend. Hierdurch bekommt die Öffnung in der Brustwand eine Grösse von mindestens  $20 \times 10$  cm. Bei dem Auseinanderdrängen der Rippen muss man jedoch darauf achten, dass man nicht Lungengewebe sprengt, das mit der

Brustkorbwand verwachsen sein kann. Eine Schockwirkung bei Eröffnung der Pleurahöhle tritt nicht ein, da die Lunge schon vor der Operation zum grossen Teil zusammengefallen ist. In der Pleurahöhle wurde in mehreren Fällen trübes Exsudat angetroffen, sogar faustgrosse, dicke Fibrinmassen, die herausgeholt wurden. Man beginnt die Losung der Verwachsung mit einem Einschnitt in die Pleura parietalis einige Millimeter von der Lungenverwachsung und löst dann die Lunge vorsichtig von der Brustwand. Hierbei bieten die Rippen, nach denen man sich vorarbeitet, eine gute Orientierungsmöglichkeit. Am schwersten ist die Ablosung im Grenzgebiet zwischen der Verwachsung und der Pneumothoraxhöhle, wo sich in der Regel eine dicke Schwarte befindet, durch die man hindurchgehen muss. Nach innen von diesem Grenzgebiet stösst man auf ein lockeres Spatium, wo das Sezieren leichter ist und die Lunge von der Brustwand mit »Tupfern« abgelöst werden kann. Ist man in diese Schicht gelangt, so ist es oft am besten, hinter das feste Grenzgebiet zu gehen und dieses nachher zu durchschneiden. Je älter die Pneumothoraxhöhle ist, um so fester adhariert die Lunge in der Grenzlinie. In einer alten Pneumothoraxhöhle kann es sogar schwer sein, die Grenze zwischen Lunge und Brustwand zu sehen, denn alles ist von einer dicken Schwarte bedeckt. Da die Losung von Verwachsungen in frischen Pneumothoraxfällen leichter ist als in alten, ist es vom operativen Gesichtspunkt wünschenswert, dass offene Pneumolyse früh ausgeführt werden kann, weshalb man nicht zu lange mit der Operation warten soll. Wir haben indes in der Regel alte Pneumothoraxfälle operiert, sogar solche mit dicken, eitrigen Exsudaten, weshalb die Ablosung in der Grenzschicht mehrfach grosse Schwierigkeiten machte.

An der Lungenkuppel finden sich eine Anzahl Bindegewebsstränge, ZUCKERKANDL's oder SEBILEAU's Ligamente, die der Ablosung einen gewissen Widerstand leisten. Wegen der Nähe von Gefässen und Nerven in der Thoraxapertur muss man hier mit besonderer Vorsicht vorgehen, wobei indes die Unterseite der ersten Rippe eine gute Orientierung ermöglicht.

Gegen das Mediastinum war die Lunge in den meisten Fällen frei, was man schon vor der Operation auf dem Röntgenbild sehen konnte, welches zeigte, dass sich eine Bucht der Pneumothoraxhöhle zwischen die Lungenspitze und das Mediastinum erstreckte. Das Fehlen mediastinaler Verwachsungen ist natürlich von grossem Vorteil. In einem Fall adharierte die Lunge jedoch breit am

Mediastinum Sie konnte indes in voller Ausdehnung bis hinab zum Eintritt des Hauptbronchus in die Lunge abgelöst werden. Zwerchfellverwachsungen haben wir niemals gelöst. Sie bereiten sicher grosse Schwierigkeiten, brauchen aber wohl selten freige-macht zu werden, denn man beschränkt die Ablösung natürlich auf das Kavernengebiet, das sich in unseren Fällen immer in der oberen Lungenhälfte befand.

Je mehr die Lunge gelöst wird, um so mehr zieht sie sich nach dem Hilus zusammen. Das Lungengewebe ist jedoch in der Regel ziemlich fest, weshalb die Kaverne während der Operation selten vollständig zusammenfällt. Volliger Kavernenkollaps tritt erst nach der Operation ein und wird beschleunigt, wenn man bei der folgenden Gasbehandlung Überdruck anwendet. Die Zusammen-ziehung während der Operation hat indes zur Folge, dass die Wundfläche der Lunge kleiner wird, und in einigen Fällen war es möglich, die Pleuraränder mit feinen Katgutsuturen zu vernähen, mit andern Worten die Wundflächen zu *pleuralisieren*. Der Saum von Pleuragewebe, der dadurch entsteht, dass der erste Einschnitt in die Pleura parietalis einige Millimeter von der Verwachsung erfolgt, kommt hierbei gut zustatten und dient als Befestigungs-stelle für die Nahte. In der Pleura visceralis, d. h. in Lungengewebe, zu nähen, ist natürlich durchaus zu verwerfen. Man muss die Wundfläche auf der Innenseite der Brustwand sich selbst überlassen, nachdem man mit peinlichster Sorgfalt eine Blutstillung durchgeführt hat.

Danach bleibt noch übrig, die Wunde in der Brustwand zu nähen, was mit grösster Sorgfalt geschehen muss. Besonders wichtig ist es, dass man die Pleuranäht möglichst dicht macht. Andernfalls tritt bei der folgenden Überdruckbehandlung Luft in die Interstitien der Brustwand aus und kann sich als Emphysem über grosse Gebiete verbreiten. Ein kleineres Emphysem um die Wunde kann man jedoch nicht vermeiden, aber dieses wird in einigen Tagen resorbiert und hat in unseren Fällen keinerlei Komplikationen herbeigeführt.

Die Brustwandwunde heilte in sämtlichen Fällen per primam, sogar in einem Fall, wo Tuberkeln auf der Pleura parietalis nach-gewiesen wurden. Die Wundheilung erfolgt offenbar ebenso un-kompliziert wie die Heilung einer Laparotomiewunde bei Peri-tonealtuberkulose.

Die Nachbehandlung ist von grosser Wichtigkeit. Sie muss energisch mit täglichen Druckmessungen erfolgen, wobei kon-

trolliert wird, dass ein ziemlich hoher Plusdruck in der Pneumothoraxhöhle bestehenbleibt. Auch sind häufige Röntgenkontrollen notwendig, weshalb der Patient im Bett photographiert werden muss. Nach der Operation bildet sich ein hamorrhagisches Exsudat in der Pleurahöhle, welches entfernt werden muss. Die Lage des Patienten im Bett muss so sein, dass die Lunge gegen den Hilus zusammensinkt und nicht von neuem mit der Brustwand verklebt. Am zweckmassigsten ist es, dass er auf der gesunden Seite liegt. Liegt er auf dem Rücken, so sinkt die Lunge nach hinten und kann dann in der costovertebralen Rinne adharieren. Durch postoperative Thorakoskopie kann man die Situation in der Pleurahöhle überblicken und eventuell entstandene Verklebungen rechtzeitig stumpf lösen oder abbrennen.

*Die intravenöse Narkose, der grosse Brustschnitt, die vorsichtige Ablosung und die energische Nachbehandlung sind also wesentliche Voraussetzungen für ein gutes Resultat offener Pneumolyse.*

Da wir in einem grosseren Zusammenhang auf die offene Pneumolyse zurückzukommen gedenken, berichten wir hier bloss über drei typische Fälle.

#### *Fall 1 M C 37jährige Frau*

Drei Geschwister sind an Lungentuberkulose gestorben, eines hat zur Zeit Lungentuberkulose und wird mit Pneumothorax behandelt, ein anderes hat Lungentuberkulose gehabt, ist aber jetzt wiederhergestellt. Die Lungentuberkulose der Patientin wurde im November 1942 diagnostiziert. Röntgenphotographie nach Aufnahme im Zentralsanatorium in Uppsala im Dezember 1942 zeigte ausgebreitete exsudative Tuberkulose im linken Spitzenfeld mit einer haselnussgrossen Kaverne in  $C_1-I_1$  sowie darunter im ganzen Lungenfeld fleckige, fibrose Veränderung. Dagegen wies die rechte Lunge nur unbedeutende Kleinfleckigkeit zentral auf. Am 4. 1. 1943 wurde Pneumothorax auf der linken Seite angelegt. Hierauf kollabierte die Lunge gut von  $I_1$  nach unten, war aber darüber, nach dem Röntgenbild zu urteilen, breit mit der Brustwand verwachsen. Unregelmässiger Pneumothorax konnte auch oberhalb des Hilus medial nach  $C_1$  hinauf beobachtet werden. Die Kaverne war nun mandarinengross geworden und füllte den grosseren Teil des mit der Brustwand zusammenhängenden Lungenteils aus. Thorakoskopie (HEDVALL) am 8. 2. ergab, dass die Lunge teils durch eine grosse Anzahl kleine und mittelgrosse Verwachsungen, teils durch eine 2,5 cm breite, sehr dicke Verwachsung gespannt war, die nach oben hinten-lateralwärts verlief, und in dieser Verwachsung ging das Lungengewebe bis zur Thoraxwand. Mit Schwierigkeit wurde in zwei Sitzungen ein Teil der Verwachsungen gelöst, die Kaverne verkleinerte sich indes nur unbedeutend, und das Sputum enthielt noch immer Tuberkelbazillen. Da die Lunge offenbar auf diese Weise nicht von der



Brustwand freigemacht werden konnte, stand man vor der Wahl zwischen Plastik und »offener Pneumolyse«. Die Patientin wollte nur den letzteren Eingriff gestatten, der deshalb am 21. 5. 1943 in der Chirurgischen Klinik ausgeführt wurde (HULTÉN). Es zeigte sich nun, dass die Lunge mit zahlreichen Verwachsungen (bis zum Durchmesser einer Kinderhand) an der Spitze und lateral unten angelotet war. Alle Verwachsungen wurden gelöst, was bloss an der Spitze Schwierigkeiten machte, wo die Lunge an einer Stelle sehr fest sass und losgeschnitten werden musste. Die Wundflächen der Lunge wurden mit einigen feinen Katgutnahten pleuralisiert, so dass sie fast überall eine glatte Pleurafläche aufwies. Die Gasbehandlungen wurden schon am folgenden Tag wieder aufgenommen. Massiger Plusdruck wurde durch häufige Zufüllungen aufrechterhalten. Nach der Operation zeigte die Lunge einen sehr guten Zusammenfall. Die Kaverne war nicht mehr sichtbar. Die Tuberkelbazillen verschwanden am 30. 7. aus dem Sputum und konnten seitdem in zahlreichen Proben nur einmal (am 10. 9.), und zwar nur sparsam beobachtet werden. Die Patientin ist entlassen und der Zustand ausgezeichnet, doch trat im Dezember 1943 ein kleineres Exsudat in der Pneumothoraxhöhle auf. Die geringfügigen Veränderungen auf der rechten Seite sind unverändert. Das Gewicht hat seit der Aufnahme um 5.6 kg zugenommen. (Siehe Abb. 1 und 2.)

*Zusammenfassung* Offene Pneumolyse bei einer 37jährigen Patientin mit einster linksseitiger Lungentuberkulose. Durch Pneumothoraxbehandlung konnte die Lunge von I<sub>1</sub> abwärts zum Kollabieren gebracht werden. Darüber war die Lunge breit mit der Brustkorbwand verwachsen. Hier befand sich eine mandarinen-grosse Kaverne. Adhärenzabbrennung war nur partiell möglich und hatte keinen Einfluss auf die Kaverne. Durch offene Pneumolyse konnte die Lunge indes in befriedigender Weise zum Kollabieren gebracht werden, worauf die Kaverne verschwand. Die Patientin, welche bazillenfrei ist und sich in sehr gutem Zustand befindet, erhält ambulatorische Gasbehandlung. Beobachtungszeit nach der Operation 10 Monate.

#### *Fall 2* 18jähriges Mädchen

Die Grosseltern mütterlicherseits sind an Lungentuberkulose gestorben. Die Lungentuberkulose der Patientin wurde im November 1913 diagnostiziert und veranlasste Aufnahme in das Zentralsanatorium in Uppsala. Röntgenphotographie am 29. 11. zeigte in der oberen Hälfte der linken Lunge ein System von Kavernen, die grösste fast pflaumengross in Hülshöhe. Ausserdem bestand Kleinfleckigkeit im rechten ScI—II. Im übrigen waren die Lungen ohne nachweisbare Veränderungen. S. R. 62 mm. Sputum reichlich Tuberkelbazillen. Am 16. 12. wurde linksseitiger Pneumothorax angelegt, der einen massigen Zusammenfall der Lunge von dem Schlüsselbein bis zur Basis hinab bewirkte. Oben hinten war die Lunge indes augenscheinlich breit mit der Brustwand



Abb 1 Fall 1 37-jährige Patientin mit grosser Kaverne apikal Zustand vor der offenen Pneumolyse



Abb 2 Fall 1 Dieselbe Patientin wie auf Abb 1 zehn Monate nach der Operation Die Patientin ist nun brustleinfrei, befindet sich in gutem Zustand und besorgt ihren Haushalt



Abb 3 Fall 2 18-jährige Patientin mit System von Kavernen in der oberen Hälfte der linken Lunge Zustand vor der offenen Pneumolyse



Abb 6 Fall 3 Derselbe Patient wie auf Abb 5 drei Wochen nach der Operation Die Lunge konnte freigebracht und die Kaverne auf der rechten Seite zum Zusammenfall gebracht werden Der Patient starb später infolge einer Hämoptyse aus einer frischen, bisal gelegenen Kaverne



Abb 5 Fall 3 21-jähriger Patient mit doppel-seitiger Lungentuberkulose und Darmtuberkulose Zustand vor der offenen Pneumolyse

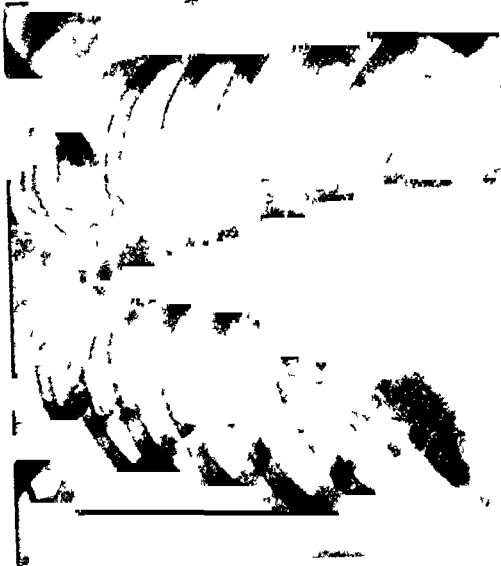


Abb 1 Fall 2 Dieselbe Patientin wie auf Abb 3 einen Monat nach der Operation Die Kavernen kollaps ist bereits bedeutend Die Patientin ist nicht ganz brüchigfrei (1 Monat nach Op.), aber der Allgemeinzustand ist befriedigend

verwachsen, und die Kavernen zeigten auch keine Tendenz zusammenzufallen. Thorakoskopie (HEDVALL) am 13. I. 1911 bestätigte die Beobachtung. Nur kleinere Verwachsungen konnten abgebrannt werden. Um die Lunge in befriedigender Weise zum Kollabieren zu bringen, war ein ergänzender Eingriff nötig. Bei der nun ausgeführten, eingehenderen Untersuchung entstand Verdacht auf beginnende Darmtuberkulose. Man erwog Plastik, glaubte aber von ihr absehen zu müssen, weil nur bei kompletter Plastik einige Aussicht bestand, die Kavernen zum Zusammenfallen zu bringen. Dasselbe Resultat konnte indes sicherer durch den bedeutend weniger angreifenden Eingriff offene Pneumolyse erzielt werden. Die Operation wurde am 13. II. in der Chirurgischen Klinik ausgeführt (HULTÉN). Hierbei zeigte sich die Lunge teilweise zusammengefallen, wurde aber oben durch eine doppelt daumendicke Verwachsung und hinten durch eine fleischige Adhärenz von der Grösse einer Kinderhandfläche gespannt, die in der Richtung zwischen der 5. und 6. Rippe verlief. Freie Flüssigkeit fand sich nicht in der Pleurahöhle. Bei Lösung der Verwachsung entstand reichliche Blutung aus mehreren Gefässen, so dass 5—6 Unterbindungen erforderlich waren. Die freigmachten Verwachsungsflächen wurden durch Vernahung mit feinem Katgut pleuralisiert. Die Gasbehandlung begann schon am folgenden Tage, wobei die Patientin auf der rechten Seite lag. Für massig hohe Plusdrucke wurde durch häufige Zufüllungen gesorgt. Ein Film, der bereits einige Tage nach dem Eingriff aufgenommen wurde, zeigte sehr guten Zusammenfall der linken Lunge. Die Kavernen verschwanden während der Nachbehandlung vollständig. Der Allgemeinzustand ist 1 Monat nach der Operation befriedigend. (Siehe Abb. 3—4.)

*Zusammenfassung.* Offene Pneumolyse bei einer 18jährigen Patientin mit doppelseitiger Lungentuberkulose. Auf der rechten Seite bestanden ziemlich unbedeutende und stationäre Veränderungen, auf der linken ein System grosser Kavernen von der Spitze bis hinab zur Hilushöhe. Linkssseitiger Pneumothorax, ergänzt durch Adhärenzabblennung, brachte die Kavernen nicht zum Zusammenfall. Offene Pneumolyse bewirkte einen sehr guten Kollaps der Lunge, und die Kavernen konnten nicht mehr beobachtet werden. Der Allgemeinzustand ist gut. Die Patientin liegt jedoch noch zu Bett. Beobachtungszeit nach der Operation 1 Monat.

### Fall 3. 21jähriger Mann

Ein Bruder hat Lungentuberkulose. Sonst keine Tuberkulose in der Familie. Der Patient erkrankte im Oktober 1939 an rechtsseitiger exsudativer Lungentuberkulose, weshalb er in das Zentralsanatorium in Uppsala aufgenommen wurde. Röntgenologisch wurde eine kompakte Verdichtung im gesamten Oberlappen festgestellt. Am 23. II. wurde rechtsseitiger Pneumothorax angelegt, worauf die Lunge unterhalb C<sub>2</sub> und oben-medial kollabierte. Zwischen C<sub>1</sub> und C<sub>2</sub> war sie indes breit

mit der Brustkorbwand verwachsen. Am 12. 2. 1940 fand Thorakoskopie statt (KRISTENSON), wobei mehrere grosse Verwachsungen abgebrannt wurden. Danach entstand ein Exsudat. Bei erneuter Thorakoskopie im Juli 1940 war es klar, dass die Lunge nicht durch Abtrennen freigemacht werden konnte. Sie war nämlich ziemlich stark flächenhaft mit dem Thorax verwachsen. Gleichzeitig war der pneumonische Prozess eingeschmolzen und eine grosse Kaverne unten im Oberlappen entstanden. Gasbehandlung wurde für aussichtslos gehalten, die Zufüllungen eingestellt und der Patient im Oktober 1940 zwecks häuslicher Bettruhe entlassen. Am 8. 1. 1941 wurde er erneut in das Zentralsanatorium aufgenommen. Die Pneumothoraxhöhle war nun ganz von Exsudat ausgefüllt. Nachdem dieses herausgeschafft und durch Luft ersetzt worden war, sah man eine pfäusengrosse Kavernenhöhle, die den medialen Teil des rechten Spitzenfeldes bis nach C<sub>2</sub> hinab einnahm, darunter war die Lunge frei, abgesehen basal. Auf der linken Lunge — früher normal — fand sich nun eine ziemlich unbedeutende Kleinfleckigkeit, die indes nach kurzer Zeit an Ausdehnung zunahm, einschmolz und schliesslich zur Entstehung einer reichlich pfäusengrossen Kaverne führte. Parallel mit Thorakocentesen auf der rechten Seite wurde nun (am 8. 2.) ein linksseitiger Pneumothorax angelegt. Dadurch wollte man versuchen, zunächst den frischen linksseitigen Prozess zu bekämpfen, um dann eventuell später die grosse rechtsseitige Kaverne durch einen chirurgischen Eingriff zum Kollabieren zu bringen. Das Sputum enthielt reichlich Tuberkelbazillen. Allmählich wurde der Zustand der linken Lunge befriedigend, die Veränderungen gingen zurück, und auch die Kaverne verschwand. Auf der rechten Seite dagegen war der Zustand stationär. Voruntersuchung zwecks eventueller Plastik ergab sowohl Myokardschaden als Darmtuberkulose. Deshalb musste Plastik als ein zu schwerer Eingriff angesehen werden. Da indes sowohl der Patient als seine Mutter einen chirurgischen Eingriff wünschten, entschied man sich für »offene Pneumolyse«, die am 19. 10. 1942 in der chirurgischen Klinik vorgenommen wurde (HULTÉN). In der Pleurahöhle wurde ca. 1½ Liter gelbgrünes Exsudat angetroffen. Das Aussehen war dasselbe wie bei früheren Entleerungen, wo mikroskopische Untersuchung zerfallende Leuko- und Lymphozyten, Detritus sowie bei Zuchtung Tuberkelbazillen ergeben hatte, also den Typus eines alten Exsudats. Dagegen enthielt die Pleurahöhle keine käsigen Massen. Von der zusammengefallenen Lunge ging ein kraftiger Balken nach hinten-lateralwärts. Die abgelöste Fläche, die sich an manchen Stellen sehr schwer freimachen liess, hatte ungefähr die Grösse einer flachen Hand. Nach der Ablösung war die Kavernenpartie ganz frei und konnte zusammenfallen. Die Gasbehandlung wurde nach zwei Tagen aufgenommen. Für massig hohen Plusdruck wurde durch häufige Zufüllungen gesorgt. Auf einer am 27. 10. aufgenommenen Röntgenphotographie konnte ein bedeutend vermehrter Zusammenfall in den oberen Teilen der Lunge konstatiert werden. Noch immer bestand jedoch medial ein Hohlraum mit Niveau. Basal-medial in der rechten Lunge war ein walnussgrosser Hohlraum hinzugekommen. Dagegen war die linke Lunge unverändert. Tuberkelbazillen fanden sich noch immer in reichlicher

Menge im Sputum. Auf einem am 12. 11. 1942 aufgenommenen Film war die apikale Kaverne auf der rechten Seite auf Haselnussgrösse zurückgegangen, die basale war nicht mehr sichtbar. Die linke Lunge hingegen war infolge weniger oft ausgeführter Zufüllungen erweitert, frühere Veränderungen konnten wieder überblickt werden, und die Kaverne hatte sich wieder geöffnet. Das Resultat der Operation war zu diesem Zeitpunkt derart, dass Besserung des Lungenzustandes und Bazillenfreiheit nach Behandlung von einigen Monaten erwartet werden konnte. Der Allgemeinzustand war gleichfalls befriedigend. Am 16. 12. 1942 starb der Patient indes plötzlich infolge einer grossen Hamoptysie. Die Sektion ergab, dass die rechte Lunge gut zusammengefallen war, mit einer apikal gelegenen Kaverne von der Grösse einer spanischen Nuss und einer frischen im Unterlappen nahe dem Hilus, von der die Blutung wahrscheinlich ausgegangen war. Es bestand reichliche frische bronchogene Aussaat. Die linke Lunge wies eine haselnussgrösse ältere Kaverne und lichte bronchogene Aussaat auf. Im Zokum fanden sich tuberkulöse Ulzerationen. (Siehe Abb. 5—6.)

*Zusammenfassung.* Offene Pneumolyse bei einem 21-jährigen, sehr kranken Patienten mit doppelseitiger Lungentuberkulose, der seit langem mit doppelseitigem Pneumothorax behandelt worden war. Auf der linken Seite war der Lungenzustand nach der Gasbehandlung befriedigend, auf der rechten bestand oben eine pfaumengrosse Kaverne, die breit mit der Brustkorbwand verwachsen war, weshalb keine Adhärenzabbrennung stattfinden konnte. Man erwog rechtsseitige Plastik. Bei der zu diesem Zweck vorgenommenen Voruntersuchung wurde indes sowohl Myokardschaden als Darmtuberkulose festgestellt, weshalb dieser Eingriff nicht in Frage kommen konnte. Auf Wunsch des Patienten und seiner Mutter wurde statt dessen offene Pneumolyse ausgeführt. Die Operation wurde gut vertragen. Basal auf der rechten Lunge schmolz indes die pneumonische Tuberkulose ein und führte zur Entstehung einer Kaverne, von der — nach der Sektion zu urteilen — die Hamoptysie ausging, die ungefähr zwei Monate nach der Operation den Tod herbeiführte.

Die Operation bewirkte in diesem Fall gleichwohl den angestrebten Zusammenfall der Lunge. Dass der Ausgang schlecht war, beruht darauf, dass die Tuberkulose des Patienten von exsudativer, progressiver Natur und allzu fortgeschritten war.

Wie im vorhergehenden mitgeteilt wurde, haben wir an 9 Patienten offene Pneumolyse vorgenommen. Die Indikation für den Eingriff war kavernöse Lungentuberkulose, bei der die Pneumothoraxbehandlung ineffektiv war infolge von Verwachsungen, die

nicht mit JACOBÆUS' Abbrennungsmethode gelöst werden konnten. Die Anzahl der operierten Fälle ist ja nicht gross, aber die erzielten Resultate müssen als vielversprechend bezeichnet werden und zur Fortsetzung anspornen. In 7 der 9 Fälle hatte die Operation ein gutes Resultat. Einer der 2 übrigen Fälle bekam etwa eine Woche nach der Operation Streptokokkenempyem, weshalb später Totalplastik mit gutem Resultat ausgeführt wurde. Die Streptokokkeninfektion kann von der Lunge oder von der Haut gekommen sein. Für die letztere Möglichkeit spricht, dass der Patient trotz sorgfältiger präoperativer Hautpflege reichlich Furunkel auf dem Rücken und in der Axille hatte. Eine gleichartige Infektionsgefahr besteht ja nicht selten auch bei Thorakoplastik. Der andere Fall (Nr. 3) starb ein paar Monate nach dem Eingriff im Sanatorium infolge von Hamoptysie aus einer frischen Kaverne an der Lungenbasis. Die Sektion zeigte, dass der Eingriff guten Einfluss auf die Spitzenkaverne gehabt hatte, so dass also der mit der Operation zunächst angestrebte Zweck erreicht war. Die Lungenveränderungen waren indes fortgeschrittener, als man vermutet hatte. Ausserdem lag eine Darmtuberkulose vor.

Bei Bewertung dieser Resultate muss man in Betracht ziehen, dass die Operationen an Patienten mit sehr ernster Tuberkulose stattfanden und dass der Allgemeinzustand in mehreren Fällen schlecht war. Einer der glücklich operierten Patienten hatte ausserdem eine ernste Myokarditis. Wenn gleichwohl in 7 dieser 9 Fälle gutes Resultat mit befriedigendem Lungenkollaps erzielt wurde, so verspricht dies Gutes für die Zukunft, wenn der Eingriff mit grosserer technischer Fertigkeit und an besser ausgewählten Fällen vorgenommen werden kann.<sup>1</sup>

### Zusammenfassung

Unter »offener Pneumolyse« verstehen die Verfasser eine Lösung von Lungenadhärenzen durch einen breit geöffneten und vollständig freigelegten Pneumothorax. Diese Operation wurde in 9 Fällen von kaverner Lungen tuberkulose ausgeführt, wo die Pneumothoraxbehandlung infolge breiter Verwachsungen ineffektiv war, die nicht nach JACOBÆUS' Methode abgebrannt werden konnten.

<sup>1</sup> Seit Abfassung dieser Arbeit haben wir weitere vier Fälle mit gutem Resultat operiert.

In sämtlichen Fällen bewirkte die Operation einen guten Zusammenfall der Kavernen. Ein Patient starb 2 Monate nach der Operation infolge einer Hämoptyse, die von einer frischen Einschmelzung in der Basispartie der Lunge ausging. Ein anderer Patient bekam ein postoperatives Kokkenempyem, weshalb Totalplastik an der Brustkorbwand vorgenommen werden musste, der Zustand ist jetzt sehr gut. In 7 Fällen wurde gutes Resultat erzielt.

Die intravenöse Narkose, der grosse Brustschnitt, die vorsichtige Ablosung und die energische Nachbehandlung sind wesentliche Voraussetzungen für ein gutes Resultat offener Pneumolyse.

### Summary.

The term, "open pneumolysis," means in this paper the detachment of pulmonary adhesions through a broadly opened and completely exposed pneumothorax. This operation was performed in nine cases of cavernous pulmonary tuberculosis, in which artificial pneumothorax was rendered ineffectual by broad adhesions which could not be cauterized according to JACOBÆUS.

In all the cases the operation led to good collapse of the caverns. One patient died two months after the operation due to hemoptysis resulting from fresh degeneration in the base of the lung. Another patient contracted postoperative pneumococcal empyema, and a plastic operation on the wall of the thorax was necessitated. The outcome in this case is now satisfying. Good results were secured in seven cases.

Intravenous anesthesia, a large incision in the wall of the thorax, careful detachment of the adhesions, and energetic post-operative treatment are all essential to a successful open pneumolysis.

### Résumé.

Par «pneumolyse ouverte» les auteurs entendent la libération des adhérences pulmonaires à la faveur d'un pneumothorax largement ouvert et complètement exposé. Cette intervention a été utilisée dans 9 cas de tuberculose pulmonaire caverneuse, où le traitement par le pneumothorax était inopérant du fait de larges adhérences qu'on n'avait pas pu sectionner par cauterisation selon la méthode de JACOBÆUS.

Dans tous ces cas l'opération a entraîné un bon collapsus des



cavernes Un malade mourut deux mois après, d'une hémoptysie ayant son point de départ dans une fonte fraîche du parenchyme de la base du poumon Un autre fut atteint d'empyème postopératoire à cocci, qui obligea à exécuter une thoracoplastie totale, et le résultat, dans ce cas, est aujourd'hui satisfaisant Dans les 7 autres il fut bon

La narcose intraveineuse, la grande incision pariétale, la prudence dans la libération et l'énergie du traitement consécutif sont les conditions essentielles du succès dans la pneumolyse ouverte

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## Two Cases of Large Hypernephroma with a Widely Varying Clinical Course.

By

P. BULL,

Oslo.

Those who have had any amount of clinical experience with hypernephroma will agree that the cases often vary so much in their clinical course that one is tempted to say that this disease more than any other bears the stamp of the patient. I have pointed out this fact in my writings on hypernephroma.<sup>1</sup> The two cases which I shall now describe are striking examples.

*Case 1.* The patient, Miss Karen L., born 1897, was mentioned on page 31 of my publication of 1935 as an example of how difficult it may be to determine from which kidney hematuria originates. At the end of 1933 she began to experience pain in the *right* lumbar region, which gradually increased in frequency and intensity. She never stayed in bed. On one occasion during this period the urine perhaps contained a little blood after she had done some heavy lifting.

She was admitted to the Lovisenberg Hospital on April 26, 1934 and reported that a more severe attack of pain had set in eight days previously and lasted three days. The pain was situated in the *right* lumbar region and radiated down the *right* leg into the foot. It kept her from sleeping at night. The urine was of normal appearance. The day before admission she had no pain and had worked at baking. In the evening the urine was dark and bloody and contained several clots. The next day she passed blood and bloody urine four or five times, but it was lighter than the day before. The clots had partly hindered the urination, but she had no pain otherwise. Examination of the urine on admission, showed two or three red blood corpuscles per field of vision. The serum urea measured 0.55.

<sup>1</sup> P. Bull: 37 hypernephroma renis og 1 hypernephroma hepatis, Oslo, 1935. P. Bull: 15 nye tilfeller av hypernephroma, Nordisk Medisin no. 36, p. 2537.

On April 27 *cystoscopic examination* showed nothing abnormal in the bladder. The urine from both kidneys was yellow, acid and had a specific weight of 1,026 and 1,019 from the right and left kidneys, respectively. Both urines contained a few red blood corpuscles. Six minutes after the injection of indigo carmine the urine from both sides was stained, but the colour on the right side was weaker even after eighteen minutes.

Pyelograms showed an abnormal kidney pelvis on both sides. On the left side was a round saccule and a process several centimeters long superiorly, parallel with the columna. The right ureter formed an angle of 90 degrees with the kidney axis and was displaced slightly medialward.

Palpation gave the impression that the right kidney was slightly larger and harder than normal. The left kidney was not palpable.

The disease history and the abnormal pyelograms were fairly strong indication of kidney tumor, but in which kidney? The rightsided pain, the possible enlargement and hardness of the right kidney and the weaker color after indigo carmine pointed to the right side. The lower specific weight of the urine and the peculiar pyelogram pointed to the left side. Was the abnormality on the left side referable to an anatomic anomaly?

Not being able to get any further in the question, I operated on April 30, making an incision over the right kidney. The kidney showed no tumor. The peritoneum was opened and the left kidney palpated. It felt a little enlarged perhaps, but I could not feel any change in consistency. I was left with the unsatisfactory diagnosis of essential hematuria, and decapsulated the right kidney. The patient was discharged on May 23. The urine was then quite normal.

On the morning of February 16, 1935, pain began in the *left* groin, followed by hematuria with clots the thickness of a finger. At noon the urine was clear again, and in the afternoon she came for cystoscopic examination. Clear urine was obtained from both ureteral orifices. During the next few days the urine again contained a slight amount of blood, and she suffered from pain on her *right* side. She was admitted on February 19 to the hospital. The bladder urine was light, flocculent, acid, and contained five to six red blood corpuscles per field.

On February 20 *cystoscopic examination* revealed light, clear urine from both sides, with a specific gravity of 1,004, and containing one blood corpuscle per field of vision. The pyelogram was the same as before, but the left kidney lay at least one vertebra too low.

On February 22 the urine was normal, and she was discharged with instructions to return as soon as she noticed blood in the urine.

Considering her bad impression of our ability to find out from where the bleeding came and after having undergone decapsulation to no avail, one could not blame the patient if she kept away from us from then on.

However, she consulted me again on April 2, 1940, and was then sent to the Red Cross Hospital. She said that two or three times a year since 1935 she had had attacks of hematuria lasting two to three days, ac-

accompanied by mild dysuria, but not by pain in the stomach or kidney region. The bleeding was always greatest the first day, when clots of blood were seen in the urine. The hematuria always came on after a special incident, e.g. heavy lifting or a chill, the last time in November 1939. In addition, during the last year she had noticed an increasing mass in the left side of the abdomen under the costal margin. It had not given her any pain but caused a feeling of tension in the abdominal cavity, especially when the mass grew so large that it made the abdominal wall protrude. Her appetite was fairly good and she had not lost weight. The bowel movements were sluggish. She had a feeling that the tumor hindered the evacuation of stools.

On admission she looked well, had no pain and was afebrile. The pulse was 70. There was no edema. The heart and lungs were normal. Examination of the abdomen revealed a large mass, bulging forward between the left costal margin and the iliac crest. It moved slightly with respiration and the abdominal wall over it felt tense. The surface was smooth and nonfluctuating. It was the size of a man's head and filled the whole region between the costal margin, iliac crest and midline. The urine was turbid and acid, had a specific gravity of 1.014 and contained a few round cells and a number of cocci. Cystoscopic examination showed a normal bladder, normal ureteral orifices, no urine through the left ureteral catheter, and clear urine at ordinary intervals from the right side, staining eight minutes after the injection of indigo carmine. The serum urea measured 0.52. Roentgen examination showed no metastases in the lungs or bones.

On April 5 *nephrectomy* was performed under lumbar anesthesia induced with 16 cc of suprarenin. A large transverse incision was made slightly above the umbilical plane. The operation was surprisingly easy. There were no enlarged glands and no visible thrombosis in the renal vein. A buttonhole opening was left posteriorly and retroperitoneally for drainage and the rest of the wound closed. The postoperative course was uneventful apart from a small lung embolus. The patient was discharged on April 25.

The removed tumor was heavy, weighing 2,500 Gm. In the lower pole were seen remains of renal tissue. The gross and microscopic appearance was typical of hypernephroma. The growth had not penetrated to the kidney pelvis.

On re-examination August 25, 1943, no recurrence could be seen. The patient had put on 20 Kg. in weight.

*Summary* The patient was a woman of 37 years of age. Despite several attacks of hematuria and four cystoscopic examinations, it was not possible to establish from which kidney the bleeding came even when the examination was done during or at any rate the day after an attack. This was partly due to the fact that the urine became entirely normal again a few hours after the attacks. Another difficulty lay in the fact that pyelograms showed an abnormal pelvis in both kidneys. Now, afterwards, it is easy enough

to see that the left pyelogram was most abnormal and pointed to a tumor in the upper pole. Nor did surgical exposure of the right kidney accompanied by transperitoneal palpation of the left one reveal the presence of tumor in the left kidney. Six and a half years after the first attack of hematuria, a tumor in the left kidney weighing 2,500 Gm was removed. It was excised without any difficulty. The patient was free of recurrence three and a half years after operation, nearly ten years after the first seizure of hematuria.

How different was the course of events in the following case!

*Case 2* Mrs Letta G, born 1885, married to a business man, had no disease of interest previously. About a year prior to admission she began to have a slight feeling of tenseness in the upper left side of the abdomen. She thought it was due to the change in diet necessitated by the war. She had no pain.

In April 1941 she began to have attacks of fever, the temperature sometimes rising to  $39.5^{\circ}\text{C}$ . The attacks would sometimes last for two weeks, and occasional chills were experienced. During the summer she had several attacks. An infected tooth root was thought to be the cause and removed, but the fever periods continued to occur without any obvious cause.

Around Christmas of 1941 the patient was measured for a new dress but no difference was noted between the right and left side. In the spring she once saw in the mirror that the left hypochondrium was larger and firmer to touch than the right. She then began to have occasional pain on the left side, especially in the back. She preferred to lie on her back, not on either side. She lost weight. The people around her saw how she had fallen off, but many others had also done so during the war. Her appetite was good. She was constipated and used laxatives.

The urination was always normal before but during the last two years she had had to get up twice a night. Urination was not painful, but occasionally there was a feeling of great urgency. She had *never seen blood in the urine* and believed that it had always been clear.

A few days before coming to our hospital she was operated on for prolapse of the uterus. Then for the first time it was noted that she had a large tumor in the left hypochondrium. Her physician and a roentgenologist believed it to be situated in the spleen.

Intravenous pyelograph, however, revealed a greatly deformed kidney pelvis on the left side, but good kidney function on both sides. The diagnosis was changed to kidney tumor, and the patient was transferred to the Red Cross Hospital.

Examination on admission June 14, 1942, showed a tall woman, thin and pale, weighing 57 Kg. The temperature was  $36.8^{\circ}\text{C}$ , pulse 60 and blood pressure 125 systolic and 75 diastolic. The tongue was moist and clean. The respiration was unhindered. The heart and lungs were normal.

The abdomen was slightly distended, especially under the left costal margin. There a large, firm tumor, moving slightly with respiration, was felt. It could be lifted slightly forwards on pressure in the lumbar region where it protruded slightly. It filled the space between the iliac crest and costal margin, disappeared up under the margin and extended a short way beyond the midline to the right. The surface was smooth. The percussion sounds were greatly dulled over the mass. There was no demonstrable ascites.

Blood studies showed a Haldane value of 68, hemoglobin 54 (Sahli), red cells 4,400,000 white cells 7,000, index 0.77 and serum urea 25 mg per hundred cubic centimeters. The urine was clear and acid and contained occasional red blood corpuscles. Cystoscopic examination was considered superfluous. Roentgen examination showed no metastases in the lungs or bones.

On June 16, 500 Gm of citrated blood was given intravenously. The next day *nephrectomy* was performed under scopolamine-morphine-nitrous oxide anesthesia. A transverse incision was made slightly above the umbilical plane. The fatty tissue around the tumor was considerably edematous. After firm ligation of the capsular veins the tumor was loosened little by little. The renal artery and ureter were ligated. Superoposteriorly the tumor was firmly attached and likewise anteriorly under the costal margin. The pancreas stretched straight across the anterior surface of the tumor's upper pole. It was easily detached from the tumor except at one place where a solid cord held it fast. The cord was ligated, it proved to be the part of the splenic artery central to the origin of the left epiploic artery, and so there was no risk of necrosis of the spleen. The tumor was then loosened fairly easily from both the central and peripheral end of the splenic artery.

The tumor was brought forward. A row of enlarged glands along the vascular trunk was followed to the origin of the renal artery in the aorta, where it was ligated again. There was *no thrombosis in the renal vein*.

There was a row of metastatic glands along the aorta, only a few of which were removed. At the bottom of the wound could now be seen the aorta, vena cava, right kidney pelvis and ureter and right renal artery.

The tumor was removed practically entire. Once only, a bit of tumor tissue squeezed out at the hilus and was taken up in compresses.

Retroperitoneal drainage was allowed for posteriorly, and the rest of the wound sewn up. The operation was difficult, lasting three and a half hours. At the end of the operation the pulse was 80.

The removed tumor was larger than a man's head, weighing 2,800 Gm. It was slightly flattened from front to back. The tumor tissue was fairly loose and the cut surface had the variegated appearance typical of hypernephroma. At the lower pole two-thirds of the kidney was preserved. The tumor originated at the upper pole and anterior surface. In the upper half of the remaining kidney were a number of tumor nodules spread out in the substance. In a few places the tumor extended down under the mucous-membrane of the kidney pelvis, but no penetration was seen anywhere.

The postoperative course was surprisingly good to begin with. The pulse varied between 72 and 92, the temperature lay around 38 C until it became normal on the sixth day. Flatus was expelled but only a slight amount, so that the abdomen soon became distended. There were loud intestinal sounds and from the fourth day on gurgling sounds were also heard. Prostigmin and enemas always caused the discharge of flatus, but soon after the abdomen grew just as much extended as before. The subjective condition was extremely good.

On June 24 the outlines of a contracted intestinal loop lying across the abdomen could be distinctly seen and felt. The urinary output amounted to 1,000 to 1,400 cc. The serum urea measured 0.17.

On June 27 the condition was unchanged. It was concluded that partial volvulus of the sigmoid flexure was present. A barium enema revealed a long sigmoid flexure, which seemed to be twisted. The next day a Stiles' catheter could be inserted to its entire length (fig 1), but neither air nor intestinal contents was exuded, even after irrigation through the catheter.

It was clear that subileus was present and it was assumed that the lesion was situated in the colon, since the general condition was so good, the diuresis so large and there was no vomiting. She had not had sufficient bowel movements since the operation ten days before, having only passed small stools two or three times. It could not be decided whether the lesion lay in the left flexure, which after the loosening during the operation might have been fastened too high up, or in the sigmoid flexure. Perhaps both places were involved. Nor was it known whether there was a volvulus of the sigmoid flexure or a kink there due to the formation of obstructive bands.

To alleviate the meteorism and stasis in the colon *appendicostomy* was performed. The abdominal cavity contained a small amount of pure, light blood (remaining after the operation?). The cecum was greatly dilated with the lower pole and appendix lying upwards and inwards. A number of collapsed loops of small intestine were seen. The appendix which was long and rather wide was brought out through the abdominal wound, fastened and, after the wound was sewn over, it was clamped and cut, leaving a stump 3 cm long. After the patient had gone back to bed the clamps were removed and a number 16 Nelaton catheter was inserted through the stump.

On June 28 a large amount of air was expelled through the fistula, some also through the anus. The abdomen was much less distended. On June 30 the patient ate with good appetite and slept better. The colon was irrigated three or four times a day with a number 18 tunnel catheter. The next day a spontaneous bowel movement occurred for the first time after the nephrectomy.

Roentgen examination was done after the injection of one liter of barium medium through the cecal fistula. The transverse colon was unusually long with three large loops (fig 2). After three hours the medium had passed through the left flexure, where there was also an extra loop of the intestine, and had reached the bottom of the sigmoid flexure. The sigmoid flexure showed a fluid level.



Fig 2

BULL Two Cases of Large Hypernephroma





On July 4 a copious bowel movement followed irrigation through the fistula and a large amount of flatus was expelled. Nevertheless, gurgling sounds were heard every day in the intestine. There was diuresis of over 2,000 cc., the urine was clear, had a specific weight of 1.010 and contained a slight amount of albumin. On July 6 operation was performed under scopolamine-dilaudid-ether-nitrous oxide anesthesia. An incision was made between the umbilicus and symphysis. The abdominal cavity contained a small amount of serous fluid. The sigmoid flexure was so long that it could be laid outside the right part of the abdomen. No torsion was present but a number of loops of small intestine were seen riding over the base of the mesosigmoid and extending down into the small pelvis. When they were drawn up, they were seen to be twisted 180 degrees clockwise. The small intestine below was slightly collapsed. Detorsion was performed and several bloody patches up to the size of a finger nail were observed in the mesentery.

Judging by the observations at operation, the subileus may be explained in the following way. Torsion of 180 degrees had occurred in a group of small intestine coils but it did not cause complete obstruction of the intestinal passage, probably because of the long mesentery and thinness of the patient. The twisted intestine had laid itself over the root of the mesosigmoid causing hindrance, likewise partial in the sigmoid flexure. This explains the good effect of the appendicostomy which would have been inexplicable had the intestinal obstacle been situated mainly in the small intestine.

The postoperative course was uneventful. Flatus was soon voided through both the fistula and anus and four days afterwards the catheter was removed from the fistula. At first the fistula was quite tight but afterwards a small amount of mucus was excreted. Only July 15 she began to sit on the edge of her bed. Her general condition was surprisingly good. The abdomen was not distended as before, but now and then slight rumbling and gurgling sounds were audible. The fistula posteriorly in the operation scar was 8 to 10 cm. long. On August 11 the appendix stump was removed. On August 16 a moderately-sized lung embolus was observed. On September 2 the patient was afebrile and could sit up.

Roentgenographic examination on September 8 showed small metastases in the apices of both lungs. The left pleural cavity contained an exudate reaching to the inferior scapular angle. The patient was feverish now and then. She was discharged on September 12.

She died on Jan. 2, 1943 of metastases.

*Summary* A large mass was noted in the left hypochondrium of a 57-year-old woman when she was hospitalized for prolapse of the uterus. It was thought to be a splenic tumor but pyelograms showed a large growth in the kidney. There was never any hematuria, the urine was clear, microscopic examination showed an occasional red blood corpuscle. The patient had only slight pain due to the distension. For fourteen months before admission she

had periods of fever up to 39.5 C of obscure origin. Roentgenograms showed no metastases.

Nephrectomy was performed after a large transverse incision. The tumor weighed 2,800 Gm. There was no thrombosis in the renal vein. Subileus developed and proved on laparotomy to be caused by torsion of 180 degrees in a group of small intestine loops lying over the base of the mesosigmoid. The sigmoid flexure was unusually long and the transverse colon had three extra loops.

She was discharged with pulmonary metastases three months after the nephrectomy and died of metastases nearly four months later.

The facts of note in this case are the insidious development of the large tumor, the lack of symptoms from the urinary passages, the demonstration of the reliability of pyelograms for differentiating between splenic and renal tumors, the periodical fever of no demonstrable origin apart from the tumor and, finally, the post-operative subileus of double origin — torsion of a group of small intestine loops lying over the base of an unusually long mesosigmoid.

I have now removed altogether forty hypernephromas with two deaths, i. e. an operation mortality of 5 per cent.

### Summary.

Two cases of hypernephroma with a widely varying clinical course are described.

The first patient was a woman 37 years of age. Despite several attacks of hematuria and four cystoscopic examinations, it was not possible to establish from which kidney the bleeding came even when the examination was done during or at any rate the day after an attack. This was partly due to the fact that the urine became entirely normal again a few hours after the attacks. Another difficulty lay in the fact that pyelograms showed an abnormal kidney pelvis on both sides. Now, afterwards, it is easy enough to see that the left pyelogram was most abnormal and pointed to a tumor in the upper pole. Nor did surgical exposure of the right kidney accompanied by transperitoneal palpation of the left one reveal the presence of tumor in the left kidney. Six and a half years after the first attack of hematuria, a tumor in the left kidney

weighing 2,500 Gm. was removed. It was excised without any difficulty. The patient was free of recurrence three and a half years after operation, nearly ten years after the first seizure of hematuria.

The second patient was a woman 57 years of age. A large mass was noted in the left hypochondrium when she was hospitalized for prolapse of the uterus. It was thought to be a splenic tumor but pyelograms showed a large growth in the kidney. There was never any hematuria; the urine was clear; microscopic examination showed an occasional red blood corpuscle. The patient had only slight pain due to the distension. For fourteen months before admission she had periods of fever up to 39.5 C. of obscure origin. Roentgenograms showed no metastases. Nephrectomy was performed after a large transverse incision.

The tumor weighed 2,800 Gm. There was no thrombosis in the renal vein. Subileus developed and proved on laparotomy to be caused by torsion of 180 degrees in a group of small intestine loops lying over the base of the mesosigmoid. The sigmoid flexure was unusually long and the transverse colon had three extra loops. She was discharged with pulmonary metastases three months after the nephrectomy and died of metastases nearly four months later.

The facts of note in this case are the insidious development of the large tumor, the lack of symptoms from the urinary passages, the demonstration of the reliability of pyelograms for differentiating between splenic and renal tumors, the periodical fever of no demonstrable origin apart from the tumor and, finally, the post-operative subileus of double origin — torsion of a group of small intestine loops lying over the base of an unusually long mesosigmoid.

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### **Zusammenfassung.**

Es werden zwei Fälle von Hypernephrom mit sehr verschiedenem klinischen Verlauf beschrieben.  
Die erste Patientin war eine Frau von 37 Jahren. Trotz mehrerer Anfälle von Hämaturie und vier zystoskopischer Untersuchungen, war es nicht möglich festzustellen, von welcher Niere die Blutung herrührte, selbst wenn die Untersuchung während eines

Anfalles oder jedenfalls am Tage nach demselben vorgenommen wurde. Dies war teilweise durch den Umstand bedingt, dass der Harn wenige Stunden nach dem Anfall wieder völlig normal wurde. Eine andere Schwierigkeit lag in dem Umstand, dass die Pyelogramme in beiden Nieren ein anormales Nierenbecken nachwiesen. Jetzt, nachtraglich, ist es leicht genug zu sehen, dass das linke Pyelogramm am stärksten verändert war und auf einen Tumor im oberen Pol deutete. Auch chirurgische Freilegung der rechten Niere in Verbindung mit transperitonealer Abtastung der linken verrieten die Gegenwart eines Tumors in der linken Niere. Nicht Sechseinhalb Jahre nach dem ersten Anfall von Hamaturie wurde ein 2,500 g wiegender Tumor der linken Niere entfernt. Er wurde ohne Schwierigkeit herausgeschnitten. Die Patientin war dreieinhalb Jahre nach der Operation, fast zehn Jahre nach dem ersten Anfall von Hamaturie, frei von Rückfällen.

Die zweite Patientin war eine Frau von 57 Jahren. Als sie wegen Gebärmuttervorfalls aufgenommen wurde, stellte man einen grossen Klumpen im linken Hypochondrium fest. Man hielt ihn für einen Milztumor, doch zeigten Pyelogramme eine grosse Geschwulst in der Niere. Hamaturie kam niemals vor. Der Harn war klar, mikroskopische Untersuchung zeigte ein vereinzeltes rotes Blutkörperchen. Die Kranke hatte nur leichte, durch die Dehnung bedingte Schmerzen. Vierzehn Monate lang vor der Aufnahme hatte sie Fieberperioden von bis  $39,5^{\circ}$  C von unklarem Ursprung. Röntgenaufnahmen zeigten keine Metastasen.

Nephrektomie wurde nach Anlegen eines grossen Transversalschnittes vorgenommen. Der Tumor wog 2,800 g. In der Nierenvene lag keine Thrombose vor. Es kam ein Subileus zur Entwicklung und erwies sich bei Laparotomie als durch eine Torsion von  $180^{\circ}$  einer Gruppe von Dunndarmschlingen bedingt, die über der Basis des Mesosigmoideums lagen. Die Sigmoideumschlinge war ungewöhnlich lang, und das Querkolon wies drei extra Schlingen auf.

Sie wurde drei Monate nach der Nephrektomie mit Lungenmetastasen entlassen und starb fast vier Monate später an Metastasen.

Bemerkenswerte Umstände sind in diesem Falle die schleichende Entwicklung des grossen Tumors, der Mangel an Symptomen seitens der Harnwege, die Veranschaulichung der Zuverlässigkeit von Pyelogrammen bei der Unterscheidung von Tumoren der Milz und der Niere, das periodische Fieber ohne irgend einen

nachweisbaren Grund, ausser dem Tumor, und schliesslich der postoperative Ileus von doppelter Herkunft — Torsion einer Gruppe von Dunndarmschlingen, über der Basis eines ungewöhnlich langen Mesosigmoideums gelegen

Verf. hat jetzt im ganzen vierzig Hypernephrome entfernt mit zwei Todesfällen, was eine Operationssterblichkeit von 5 Prozent ergibt

### Résumé.

Description de deux cas d'hypernéphrome avec un cours clinique très varié

La première malade était une femme de 37 ans. Malgré plusieurs attaques d'hématurie et quatre examens cystoscopiques, il n'était pas possible de savoir de quel rein venait le saignement, même quand l'examen était fait le même jour ou au moins le jour après l'attaque. Ceci était en partie dû au fait que l'urine redevenait complètement normale quelques heures après les attaques. Une autre difficulté était que les pyélogrammes ont montré un bassin du rein anormal aux deux côtés. Maintenant, plus tard, il est facile de voir que le pyélogramme gauche était anormal et indiquait une tumeur dans le pôle supérieur. Non plus l'exposition chirurgicale du rein droit accompagnée par palpation transpéritonéale du gauche n'a révélé la présence d'une tumeur dans le rein gauche. Six ans et demi après la première attaque d'hématurie, une tumeur dans le rein gauche, pesant 2,500 grammes, fut extirpée, sans difficulté. La malade n'avait pas de récurrence pendant 3 ans et demi après l'opération, presque 10 ans après la première attaque d'hématurie.

La seconde malade était une femme de 57 ans. Une masse large fut observée dans l'hypocondre gauche, quand elle fut hospitalisée à cause de prolapsus de l'utérus. On avait l'opinion qu'il s'agissait d'une tumeur splénique, mais les pyélogrammes ont démontré une grande excroissance dans le rein. Elle n'avait jamais hématurie, l'urine était claire, examen microscopique démontra une hématurie occasionnelle. La malade n'a que peine légère à cause de la distension. Quatorze mois avant l'entrée elle avait périodes de fièvre jusqu'à 39.5° C d'origine obscure. Les roentgenogrammes n'ont pas montré de métastases.

Néphrectomie s'effectua après une grande incision transverse. La tumeur pesait 2,800 grammes. Il n'y avait pas de thrombose.

dans la veine rénale Subileus se développait et, à laparotomie, se montrait être causé par une torsion de 180 degrés dans un groupe d'anses de l'intestin grêle, situées à la base du mesosigmoïde La flexion sigmoïde était particulièrement longue et le côlon transverse avait trois anses en sus

Elle sortit de l'hôpital avec des métastases pulmonaires trois mois après la néphrectomie et mourut de métastases à peu près quatre mois plus tard

Les faits à noter dans ce cas sont le développement insidieux de la tumeur large, l'absence de symptômes des passages urinaires, la démonstration de l'exactitude des pyelogrammes pour différenciation entre tumeurs spléniques et rénales, la fièvre périodique sans autre origine démontrable que la tumeur et, finalement, le subileus postopératif d'origine double — torsion d'un groupe d'anses de l'intestin grêle à la base d'un mesosigmoïde particulièrement long

L'auteur a maintenant extirpé quarante hypernéphromes avec deux morts, ainsi une mortalité d'opération de 5 pour cent

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## Fracture de la colonne vertébrale comme complication du traitement des psychoses par le choc.

Par

M ANDREASSEN et E DAHL-IVERSEN

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Le traitement des psychoses par le choc s'emploie au Danemark depuis 1937. En 1941 on communiqua dans la Société de Psychiatrie danoise des rapports sur ce traitement de 1937 à 1940. Dans ces rapports qui comprennent 2 084 malades de pour ainsi dire tous les hôpitaux d'aliénés du Danemark, se trouve un chapitre spécial sur les complications. On y signale qu'après les affections cardiaques et pulmonaires, ce sont les lésions chirurgicales qui sont la complication la plus fréquemment rencontrée dans le traitement par le choc.

Les lésions chirurgicales comprennent les luxations et les fractures des os longs ainsi que les fractures de la colonne vertébrale. Ces dernières sont regardées comme la complication chirurgicale la plus fréquente. Parmi 1 500 malades traités au cardiazol, il y a, d'après les rapports de la Société de Psychiatrie, 12 fractures de la colonne vertébrale, lesquelles semblent toutes être de légères fractures de compression du bord antérieur du corps vertébral sans tendance à donner de gênes durables.

On a publié de nombreuses communications dans la bibliographie étrangère sur ces fractures depuis que le premier cas a été communiqué par STALKER en 1938. Quelques auteurs, tels que VALSOE, ANDROP, MARGOLIN et autres, de même que les auteurs des rapports de la Société de Psychiatrie, considèrent ces fractures comme étant assez insignifiantes, tandis que d'autres,



tels que VOGT PELATIN, FRIEDMANN, HARRIS et HORWITZ, leur donnent une certaine importance qui amoindrit l'emploi du traitement par le choc

La question ne paraissant pas être complètement élucidée, nous avons trouvé qu'il était opportun d'éclaircir ce sujet en partant d'une assez grande documentation danoise et en faisant une *évaluation chirurgicale* des types de fracture, de leur traitement et de leur pronostique, surtout qu'un tel procédé n'a pas été employé antérieurement

La *documentation* comprend 27 fractures de la colonne vertébrale parmi 1 248 malades de services danois, traités par le choc<sup>1</sup>

Oringe Sindsygehospital	700 malades dont	8 fractures			
Rigshospitalets psykiatriske Klinik	242	—	—	3	—
Bispebjerg Hospital, Afd E	157	—	—	11	—
Kommunehospital, 6 Afd	149	—	—	5	—

Le procédé dans le traitement par le choc, qui a été introduit par VON MEDUNA, diffère un peu dans les différents services. Le choc est produit comme *choc d'insuline* par des injections d'insuline répétées jusqu'à ce que le malade soit dans le coma, ou comme une *thérapeutique de sommation* dans laquelle le traitement à l'insuline est suppléé par des injections de cardiazol. De plus, le choc peut être produit par l'*injection intraveineuse* de cardiazol ou de produits de même nature (métrazol, pentazol, azoman). Finalement, le choc peut être produit par l'*électricité*.

De ces méthodes, c'est le traitement au cardiazol qui semble être le plus utilisé. Le but de ce traitement est que le malade ait une crampe après un état latent qui ne doit guère dépasser 10—15 secondes. Nous n'approfondirons d'ailleurs pas ici la technique, mais nous alléguerons seulement qu'il ne semble pas y avoir de différence dans les complications par les différentes méthodes.

Les 27 fractures ont été diagnostiquées par la radiographie, car tous les malades qui se sont plaints de douleurs dans le dos après le traitement par le choc, ont été radiographiés. Toutefois, les symptômes dans ces fractures sont souvent assez indéfinis : douleurs vagues entre les omoplates, un peu de sensibilité directe et parfois indirecte, de sorte qu'on ne peut pas écarter la possibilité

<sup>1</sup> Nous remercions les chefs des services en question M le Dr Askgaard, M le Professeur, Dr Helweg, M le Dr Clemmensen et M le Dr Reiter, d'avoir mis la documentation à notre disposition.

que d'autres malades aussi aient des fractures On n'a pas observé de *symptômes neurologiques* parmi ces 27 cas

La localisation prédominante des fractures est la région supérieure de la colonne dorsale, répondant à sa plus grande cyphose Leur siège et leur nombre chez chaque malade ressortent du tableau I

Siège des fractures			Nombre				
3 <sup>me</sup> vertèbre dorsale	1 fracture	Chez	9 malades	on trouve	1 fracture		
4 <sup>me</sup> » »	5 »	»	13	»	»	2	»
5 <sup>me</sup> » »	15 »	»	4	»	»	3	»
6 <sup>me</sup> » »	17 »	»	1	»	»	4	»
7 <sup>me</sup> » »	6 »						
8 <sup>me</sup> » »	2 »						
10 <sup>me</sup> » »	1 »						
11 <sup>me</sup> » »	2 »						
12 <sup>me</sup> » »	1 »						
3 <sup>me</sup> » lombaire	1 »						

Les fractures sont multiples chez 18 des 27 malades Dans ces cas, ainsi qu'il en ressort de la figure I, la localisation est dans les vertèbres avoisinantes, dans 2 cas seulement on trouve des corps vertébraux intacts entre les fracturés

Les types de fracture appartiennent aux types les plus simples des fractures du corps

soit 1) une fracture du corps isolée (fracture de compression, fracture du bord,

soit 2) une fracture du corps avec lésion du disque, mais sans déplacement de la vertèbre

On voit sur la figure II les différentes fractures reproduites graphiquement d'après les radiographies, de la sorte que la vertèbre affectée est dessinée avec le contour du bord antérieur du corps vertébral intact le plus proche On obtient de cette façon une impression du degré de compression

Pour autant qu'on peut juger des radiographies, on verra que 11 fractures sont des fractures du corps isolées avec compression du corps jusqu'à la moitié de sa hauteur normale et avec une délimitation régulière de la surface du corps

Les autres fractures sont des fractures du corps avec une lésion de sa surface et, par là, probablement avec une lésion du disque. Il y a une compression variable de la partie antérieure du corps On considère ce type de fracture comme étant plus compliqué que le premier, car la lésion du disque amène la pénétration du

tissu nucléaire dans le corps où il agit de la même manière que l'interposition des parties molles et empêche l'ossification endostale, ainsi que l'allègue LOB. On en voit un exemple typique sur la radiographie, figure III, où le tissu du disque pénètre dans le corps comme une hernie du nucléus.

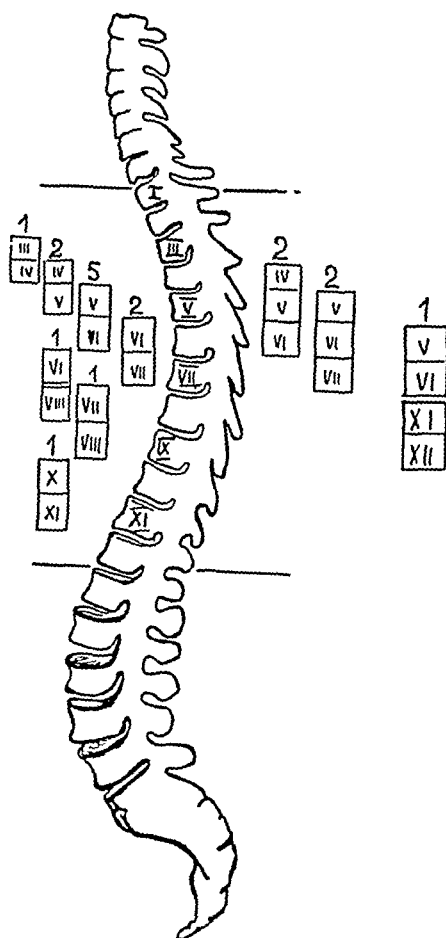


Fig 1 Localisation des fractures par multiplicité

Les fractures, vues de face, sont presque toujours symétriques, probablement en raison de la contraction symétrique du muscle. Cette corrélation explique peut-être pourquoi la fracture du corps avec subluxation ou luxation de la vertèbre n'est pas observée. Cette même corrélation est peut-être la cause de la grande rareté des complications neurologiques. Nous n'avons trouvé aucun cas ayant des symptômes neurologiques dans notre documentation.

*Pathogénie* Il n'existe dans la bibliographie aucune indication

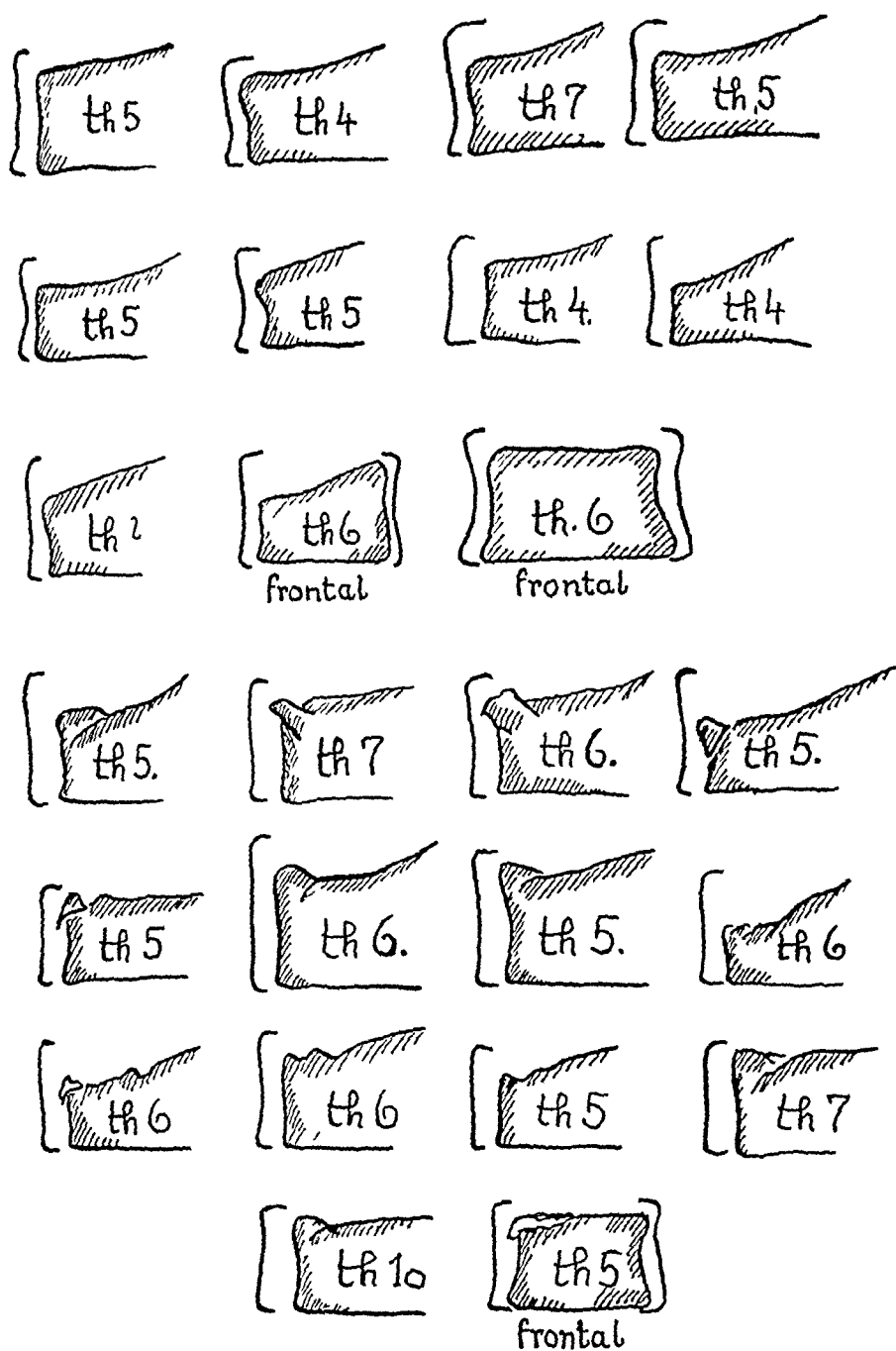


Fig 2 Représentation graphique des types de fracture

précise du mécanisme dans l'apparition de ces fractures du rachis, ni aucun essai d'expliquer pourquoi les fractures sont les plus fréquentes dans la région dorsale

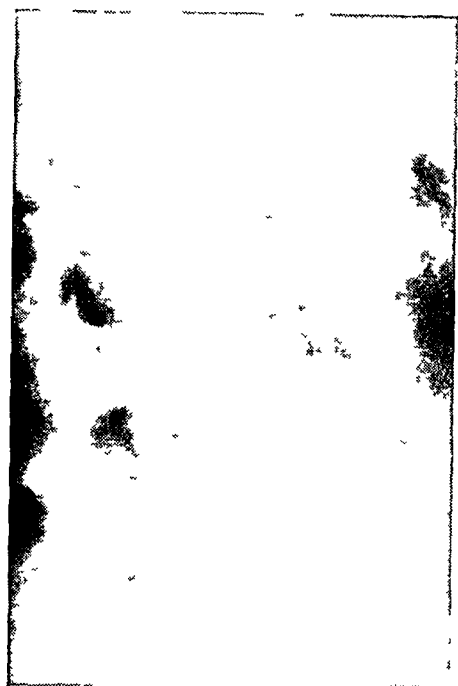


Fig 3 Hernie du nucleus dans le troisième corps lombaire

WESPI pense que les fractures surviennent en raison de la contraction maximum des muscles lombaires qui détermine l'opisthotonos, et POLATIN, FRIEDMANN, HARRIS et HORWITZ laissent voir la même interprétation quand ils essayent prophylactiquement de fixer le malade dans une forte flexion pendant le traitement. Ces interprétations ne doivent pas être justes, car c'est toujours sur la face antérieure du corps que surviennent les fractures.

PALMER pense que, dans l'entier, une fixation du malade doit disposer à une fracture, et MOFFAT donne à entendre que le manque de chaux peut provoquer la lésion. Cette hypothèse a aussi été prédominante au Danemark, car plusieurs services ont autrefois entrepris la radiographie du tibia avant le traitement, afin d'exclure le manque de chaux. Cependant, ces hypothèses sont infirmées entre autres par POORT et FAUERBY. Ces auteurs ont trouvé une chaux de sérum normale chez 9 malades ayant des fractures après le traitement par le choc. HAHNEMANN aussi a contribué à infirmer cette hypothèse. Il allègue que la chaux doit particulièrement manquer pendant la grossesse ou la puer-

péralité, et que, par conséquent, on peut surtout s'attendre à des fractures dans le traitement par le choc. Néanmoins, il n'a pas vu de fractures dans le traitement par le choc de 18 malades enceintes. Il faut toutefois faire remarquer que les malades n'ont pas été examinées aux Rayons X.

La juste explication pathogénique est probablement, ainsi que le pensent DEDICHEN, et au Danemark, HAHNEMANN, que les fractures surviennent en raison d'une forte flexion ventrale subite de la région supérieure du rachis.

Pour se faire une idée du mécanisme de la fracture, il faut se rappeler la construction du rachis dans l'ensemble et les rapports des vertèbres entre elles, de même que leur motilité. Ainsi qu'il ressort de la figure I, la cyphose dorsale répond aux 5<sup>me</sup> et 6<sup>me</sup> vertèbres dorsales ou elle atteint son plus haut degré. Comme on le sait, la flexion ventrale et la flexion dorsale dans le rachis se font le plus librement dans les vertèbres lombaires et cervicales, et le moins librement dans la région dorsale où les petits disques intervertébraux et la relation intime entre les laminae et l'épines dorsales restreignent sensiblement la motilité. Selon FICK, les 5<sup>me</sup> et 6<sup>me</sup> vertèbres dorsales seraient les vertèbres les plus faibles du rachis, mais cela n'est pas confirmé dans le reste de la bibliographie anatomique.

En raison de la cyphose et de la faible motilité dans le sens ventral, on comprendra qu'il puisse survenir des fractures dans les vertèbres au plus haut point de la cyphose s'il survient de fortes et subites flexions ventrales dans la colonne dorsale.

Il y a plusieurs phases pendant un choc. Après l'injection de la substance provoquant le choc (le cardiazol, par exemple), il y a un état latent de quelques secondes pendant lequel le malade est encore en pleine connaissance. Pendant ce temps, peut-être parce qu'il sent venir les crampes, le malade essaie de se redresser de la position couchée par des mouvements saccadés qui lèvent la tête et le cou à une certaine hauteur de la couche. Puis il perd connaissance et les contractions cloniques et toniques surviennent, de sorte que le malade entre dans l'opisthotonos aussi longtemps que dure l'accès. Il arrive donc pendant la première phase de subites flexions ventrales saccadées dans la colonne dorsale, dans les dernières phases, une flexion dorsale continue, la plus prononcée dans la région lombaire. Il est admissible de supposer que la fracture survient pendant la première phase. Il y a également des phases dans le tétanos, et là aussi, on trouve

des fractures du bord antérieur du corps dans la région dorsale supérieure (WINTERSTEIN)

*Prophylaxie* Dans chaque cas de traitement par le choc, on doit, ainsi que cela a été introduit au Danemark, entreprendre la radiographie du rachis, afin d'exclure l'halistérèse et les fractures antérieures

De plus, il importe grandement d'empêcher les violents mouvements des muscles. De côté américain surtout, on a fait beaucoup de suggestions pour les éviter. On a ainsi recommandé de donner le choc sous l'anesthésie lombaire ou après une injection de curare, de sorte que le système musculaire est entièrement hors de jeu.

Il est cependant encore plus important de donner une position déterminée au malade pendant le traitement, ainsi que l'indique DEDICHEN et que HAHNEMANN l'a mis en système.

HAHNEMANN étend le malade de telle manière qu'on évite les mouvements saccadés pendant l'état latent. Le malade est étendu sur le dos, sur un matelas fixe, les extrémités tendues. Il faut qu'il y ait de la marge entre les extrémités de lit et la tête et les pieds du malade. On roule une couverture sous ses épaules afin de redresser la cyphose dorsale. L'injection faite, le médecin prend les poignets du malade et force ses épaules en arrière en y plaçant ses mains et les poignets du malade. HAHNEMANN a traité de cette manière plus de 600 malades sans avoir eu un seul cas de fracture.

Finalement, pour déterminer l'importance de ces fractures du rachis, il importe, comme on l'a dit plus haut, de se faire une idée de leur fréquence, leur traitement et leur pronostique.

Pour ce qui concerne la fréquence, le chiffre varie beaucoup. VON MEDUNA a publié en 1939 une documentation de 2 937 malades dont aucun n'avait de fracture du rachis, mais chez lesquels ce dernier n'avait également pas été radiographié. La même année, POLATIN, FRIEDMANN, HARRIS et HORWITZ publièrent 58 cas qui avaient tous été examinés aux Rayons X et dont 22 (43 %) avaient des fractures. En même temps, KRAUSE et VIERSMA publiaient 51 cas radiographiés dont 8 avaient des fractures. Comme nous l'avons dit précédemment dans notre documentation où seuls les malades qui se sont plaints de douleurs dorsales, ont été radiographiés 27 de 1 248 malades avaient des fractures, c'est à dire 2—3 %. On peut en déduire que la fréquence des fractures augmente avec la minutie apportée à l'examen aux

Rayons X, et que le chiffre exact de la fréquence ne peut être indiqué à moins que tous les malades ne soient examinés aux Rayons X après le traitement

Le traitement des fractures doit se faire selon les principes donnés par MAGNUS le traitement fonctionnel dans lequel la donnée essentielle est la mobilisation précoce, soutenue par le massage et la gymnastique médicale Il ressort des examens faits par LOB que cette méthode est la meilleure, justement pour tous ces types de fracture Ces examens montrent que la guérison de la fracture du corps se fait par la formation d'un cal périostal qui est peu abondant et qui ne se trouve qu'à proximité immédiate de l'endroit de la fracture, ce qui avance la guérison si on garde la gomphose existant auparavant La guérison est un peu entravée dans les lésions du disque par un tissu nucléaire pénétrant Dans l'entier, les fractures du genre décrit ici, doivent être traitées par l'altement pendant 2—3 semaines Pendant cette période on peut donner un coussin électrique, du massage et, petit à petit, faire des exercices de gymnastique faciles Dans ces cas-ci comme dans les fractures du rachis en général, il importe pour la guérison du malade, que ce dernier sache le moins possible qu'il a une fracture ou, mieux encore, qu'il l'ignore complètement

Parmi ces 27 fractures, un peu plus de la moitié ont été traitées selon ces principes et n'offrent aucune gêne à l'examen ultérieur Selon les principes du traitement fonctionnel, les cas restants ont été immobilisés trop longtemps Parmi ces derniers, on en trouve qui ont des gênes, ce qu'on peut voir sur le schéma ci-dessous Le type des fractures ne diffère pas ici de celui du premier groupe, et l'âge et les conditions de travail sont, dans l'entier, les mêmes pour les deux groupes

Comme résultat de nos recherches nous pouvons énoncer que les fractures du rachis produites par le traitement des psychoses par le choc, sont presque toujours des fractures légères fractures

Schema de l'examen ultérieur des fractures

Traitement	Temps d'observation	Pas de gênes	gênes légères	gênes graves
Alttement pendant 2—4 semaines				
16 malades {	1—4 mois	11	0	0
	plus de 4 mois	5	0	0
Alttement pendant plus de 4 semaines				
11 malades {	1—4 mois	3	2	0
	plus de 4 mois	3	1	1
Les renseignements sur un malade manquent				



isolées du corps ou fractures du corps avec lésion du disque. Elles sont presque toujours symétriques et donnent rarement de symptômes nerveux. Le risque de la fracture peut être réduit par la position du malade introduite par HAHNEMANN. Une fracture provoquée est facile à traiter et doit l'être selon les principes de la méthode fonctionnelle. Les résultats du traitement sont bons.

D'un point de vue chirurgical, cette complication est par conséquent assez insignifiante et ne semble pas être un empêchement à l'application du traitement par le choc.

### Résumé

La documentation comprend 27 fractures de la colonne vertébrale parmi 1 248 malades de services danois, traités par le choc. Le traitement au cardiazol semble être le plus utilisé. Il ne semble pas y avoir de différence dans les complications par les différentes méthodes du traitement par le choc. Les 27 fractures ont été diagnostiquées par la radiographie chez les malades qui se sont plaints de douleurs dans le dos. La localisation prédominante des fractures est la région supérieure de la colonne dorsale, répondant à sa plus grande cyphose. La localisation la plus fréquente est les corps 5 et 6. Les fractures sont multiples chez 18 des 27 malades. Dans ces cas la localisation est le plus souvent dans les vertèbres avoisinantes. Les types de fracture appartiennent aux types les plus simples des fractures du corps : la fracture du corps isolée (fracture de compression, fracture du bord) et la fracture du corps avec lésion du disque, mais sans déplacement de la vertèbre. Les 11 fractures sont des fractures du corps isolées et les autres sont des fractures du corps avec lésion de sa surface et, par là, probablement avec une lésion du disque. Les fractures, vues de face, sont presque toujours symétriques. Les complications neurologiques sont très rares. Nous n'avons trouvé aucun cas ayant des symptômes neurologiques dans notre documentation.

La *pathogénie* de ces fractures est probablement que les fractures surviennent en raison d'une forte flexion ventrale subite de la région supérieure du rachis. Dans l'état latent après l'injection le malade essaie de se redresser de la position couchée par des mouvements saccadés qui lèvent la tête et le cou à une certaine hauteur de la couche.

La *prophylaxie* contre cette complication est d'empêcher les

violents mouvements saccadés pendant l'état latent On roule une couverture sous ses épaules afin de redresser la cyphose dorsale L'injection faite, le médecin prend les poignets du malade et force ses épaules en arrière en y plaçant ses mains et les poignets du malade

Le *traitement* des fractures doit se faire selon les principes donnés par MAGNUS le traitement fonctionnel Parmi les 27 malades, un peu plus de la moitié ont été traités selon ces principes et n'offrent aucune gêne à l'examen ultérieur Les cas restants ont été immobilisés trop longtemps Parmi ces derniers, on en trouve qui ont des gênes Le type des fractures, l'âge et les conditions de travail sont, dans l'entier, les mêmes pour les deux groupes

*Conclusions* Les fractures du rachis produites par le traitement des psychoses par le choc sont presque toujours des fractures légères qui donnent rarement de symptômes nerveux Elles sont faciles à traiter et doit l'être selon les principes de la méthode fonctionnelle. Les résultats du traitement sont bons D'un point de vue chirurgical, cette complication est assez insignifiante et ne semble pas être un empêchement à l'application du traitement par le choc

### Summary.

The material comprises 27 fractures of the column in 1,248 patients in Danish asylums, subjected to shock treatment The treatment with cardiazol has been most frequently used There seems to be no difference as regards the complications brought about by the different methods of shock treatment The 27 fractures were diagnosticated by means of roentgen examination of the patients, who complained of pains in the back after the shock treatment The most predominant localization of the fractures is the superior part of the thoracic column, corresponding to its greatest kyphosis Most frequently the fracture was localized to the 5th or 6th vertebral body In 16 of the 27 patients the fractures were manifold In these cases they are most often to be found in the neighbouring vertebrae The types of fracture are either isolated vertebral fractures (compression fractures, border fractures) or vertebral fractures with disk lesion but without displacement of the vertebrae 11 fractures are isolated vertebral fractures and the others are vertebral fractures with surface lesion and, consequently, probably also with disk lesion Seen from the front,

the fractures are almost always symmetrical. Neurologic complications are extremely rare. No case showing neurologic symptoms has been found in our material.

The *pathogenesis* of these fractures is probably that the fractures are caused by a sudden violent ventral flexion of the superior part of the thoracic column. In the latent period following the injection, the patient tries to get up from his recumbent position by means of jerking movements, which raises his head and neck to a certain height from the bed.

The *prophylaxis* against this complication consists in preventing his violent jerking movements during the latent period. A coverlet is rolled up under his shoulders, in order to straighten the thoracic kyphosis. When the injection has been given the physician takes the patient's wrists and forces his shoulders backwards, pressing his own hands and the patient's wrists against it.

The *treatment* of the fractures should be done according to the principles given by MAGNUS the functional method. A little more than half of the 27 patients was treated according to this method, and they do not show any troubles at the complementary examination. The remaining cases were immobilized too long. Among these one finds the cases that have had troubles. The type of fractures, the age and the working conditions are, on the whole, the same for the two groups.

*Conclusion.* The fractures of the column produced by shock treatment are almost always light fractures, which seldom give rise to any nervous symptoms. They are easy to treat and should be treated according to the functional method. The results of the treatment are good. From the surgical point of view this complication is rather insignificant and does not seem to present any obstacle in the use of the shock treatment.

### Zusammenfassung.

Das Material umfasst 27 Wirbelbrüche unter 1248 schockbehandelten Patienten in dänischen Irrenabteilungen. Am häufigsten war Cardiazolbehandlung verwendet worden. Es scheint kein Unterschied in bezug auf die Komplikationen vorzuliegen bei den verschiedenen, zur Erzeugung eines Schocks verwendeten Verfahren. Die 27 Wirbelbrüche wurden durch Röntgenaufnahme der nach der Schockbehandlung über Rückenschmerzen klagenden

Patienten festgestellt Die häufigste Lokalisation der Frakturen ist die oberste Partie der Brustwirbelsäule, der stärksten Kyphose derselben entsprechend Am häufigsten war der Bruch im 5 oder 6 Brustwirbel lokalisiert Bei 18 der 27 Kranken sind die Frakturen multipel In diesen Fällen sitzen sie zumeist in benachbarten Wirbeln Die Frakturtypen sind entweder isolierte Korpusbrüche (Kompressionsbruch, Randbruch) oder Korpusbrüche mit Zwischenwirbelscheibenverletzung, aber ohne Wirbelverschiebung 11 der Brüche sind isolierte Korpusfrakturen, während die übrigen Korpusbrüche mit Verletzung der Wirbeldeckplatte, und damit vermeintlich auch der Zwischenwirbelscheibe, darstellten Die Brüche sind im Frontalbilde so gut wie immer symmetrisch Neurologische Komplikationen sind sehr selten und kommen bei unseren Fällen nicht vor

Die Pathogenese dieser Brüche ist wahrscheinlich die, dass die Frakturen durch eine plotzliche, starke Ventralflexion der obersten Partie der Wirbelsäule zustande kommen In der Latenzperiode nach der Injektion versucht der Kranke, sich durch ruckformige Bewegungen, die Kopf und Hals ein Stück von der Unterlage entfernen, aus der liegenden Stellung zu erheben

Die *Prophylaxe* gegen diese Komplikation besteht darin, den Kranken so hinzulegen, dass die ruckformigen Bewegungen in der Latenzzeit vermieden werden Eine zusammengerollte Decke wird unter die Schultern gelegt, um die Thorakalkyphose zu strecken Nachdem die Injektion gegeben ist, ergreift der Arzt die Handgelenke des Kranken und zwingt seine Schultern nach hinten, indem er seine eigenen Hände und die Handgelenke des Patienten dagegen drückt

Die *Behandlung* der Frakturen hat nach den von MAGNUS angegebenen Grundsätzen stattzufinden funktionelle Methode Von den 27 Kranken wurde reichlich die Hälfte nach diesen Grundsätzen behandelt und weist bei der Nachuntersuchung keine Beschwerden auf Die übrigen wurden zu lange immobilisiert Unter diesen findet man die Fälle, die Beschwerden haben Der Typus der Frakturen, das Alter und die Arbeitsverhältnisse sind in den beiden Gruppen im grossen ganzen gleichartig

*Schlussfolgerung* Die Wirbelbrüche bei der Schockbehandlung stellen fast immer leichtere Frakturen dar, die selten Nervensymptome geben Sie sind leicht zu behandeln und sollen nach den Grundsätzen der funktionellen Methode behandelt werden Die Behandlungsergebnisse sind gut Vom chirurgischen Ge-

sichtspunkte aus ist diese Komplikation recht unwesentlich und scheint kein Hindernis für die Verwendung der Schockbehandlung darzustellen

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From the Orthopaedic Clinic, Oslo  
(Chief Surgeon E PLATOU, M D)

## Treatment of Various Deforming Affections of the Hip-joint by Resection of the Acetabulum ad modum Smith Petersen.

By

E PLATOU M D

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On page 91 of "Nordisk Medicin" for 1940, I gave an account of a new method for the treatment of arthrosis in the hip-joint, put forward by SMITH PETERSEN. I there described my experiences in the first 18 cases, with an observation-time varying between 3 years and  $1\frac{1}{2}$  year, only one half of which extended over more than a year. The results were very good, but the number of cases was very small, of course, and the observation-period short, so that it was impossible to make any reliable deductions.

Now, however, I have operated altogether 107 patients and a total of 117 hip-joints. Of these totals, 73 patients and, altogether, 79 hip-joints were operated more than  $1\frac{1}{2}$  year ago, so that a summary of the results will now be able to determine whether or no this palliative operation has had lasting beneficial results.

I may be permitted, first of all, to give a brief description of what is performed. A longitudinal section from spina ili ant sup, for about 15 cm (6 inch) down the thigh exposes the hip-joint, as one dissects downwards, laterally of m sartorius and medially of rectus femoris. No other musculature is cut across than the fibres extending from the articular capsule to rectus. Then there is removed a piece of the anterior articular capsule, of about the size of a florin, and chiselled away a part of the anterior roof of the acetabulum just below the attachment of rectus, and downwards

as far as one can reach The size of this piece of bone depends on the size of the limbus, but it may vary between that of a florin down to a very narrow strip If large osteophytes are present on caput femoris, they must be chiselled away as far as one can reach Down on caput it is sometimes possible to remove pieces as large as a brazil-nut In addition, there is always removed as much as possible of synovialis when there exists hyperplasia with cock's comb-like excrescences Before the operation, a subcutaneous section of the tendon anteriorly of m pectineus is sometimes indicated

We know, of course, that it is very difficult to help these patients, and by far the greater number of my cases have been treated for years with all the physico-therapeutical means we have at our command Roentgen, massage, short-wave treatment and mud-baths have all been tried and, as a rule, to little purpose

On account of travelling conditions in Norway at the present time, it has been impossible to make personal control-examinations of all the patients I have been obliged to satisfy myself with an interrogatory-scheme, to which all the patients have replied Only those cases operated before  $\frac{1}{1}$  1943 have been included To give here at once a *summary of the principal results, it may be stated that, of 73 patients, 52 have replied that they are improved and contented, i e that there is a 71.2 % good result, 21 patients have answered that they are not contented*

Now, as we know that we are discussing an affection for which, as a rule, all physico-therapeutical means are of no help, the results obtained by the new method now in question are so good that it may be considered as one of permanent value

It is pain that leads a patient to a doctor, and the only method which, in about 100 % of the cases, confers freedom from pain is arthrodesis But its employment is a considerably greater operation, and a stiff hip is a serious drawback for a patient 40 years of age When I say, freedom from pain in about 100 % of the cases, it is because one does not always gain complete immobilization

Arthroplasty with vitalium-cup ad mod SMITH-PETERSEN, or by an ordinary method, is a more serious operation and gives no better results

My material consists of 13 men of an average age of 54, the youngest being 42 and the eldest 69, and 60 women, whose average age was 49, the youngest being 13 and the

oldest 58. Altogether, there were 21 patients less than 40 years of age. The average stay at the hospital was 56 days. Of these patients, 6 underwent bilateral operation, so that, in all, there were 79 hip-joints treated.

If we investigate the conditions of pain and mobility in the hip after operation we obtain the following figures:

Pain		Mobility	
None	30	Improved	53
Less	35	Unaltered	70
Unaltered	14	Less	16
(a few, more pain)			

By means of this palliative operation, therefore, we have the result that 38 % of the cases have become free from pain, and that 66 % have improved mobility. With a control-investigation period varying between 7 and 3 years, covering 43 patients, we find that 13 are not improved. With a control-period of from 3 years to 1 year we have 30 patients, of whom 8 were not better. This gives us 28 % and 27 %, respectively. When improvement has begun, the figures just given seem to show that, essentially, it is permanent, otherwise the longer-period group would certainly have shown worse results than the shorter-period one.

Of the six bilateral operations, 5 are contented and 1 not.

The roentgenograms of arthritis deformans coxae differ extremely, of course. To obtain a survey over the present material, I have drawn up 3 groups which are explained by the 3 following divisions:

1 Where the outline of caput is essentially retained, and where caput stands deep in acetabulum, and with minimum cleavage,

2 Highly deformed caput and acetabulum, with severe diminution of cartilage, with more or less subluxation,

3 Subluxation with slight deformation, but with greatly varying diminution of cartilage.

Group 1	22	hip-joints	not improved	7	i. e.	31.8 %
»	2	39	»	»	9	» 23 %
»	3	18	»	»	5	» 27.7 %

The figures are small, so the calculated percentage of poor results does not give any dependable picture, but there does not seem to exist any very distinctive difference between the groups. One would, of course, expect Group 1 to have given the best result.



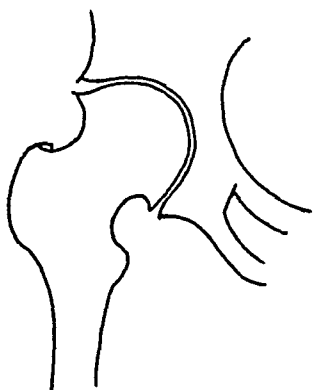


Fig 1

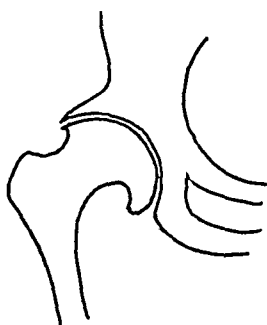


Fig 2

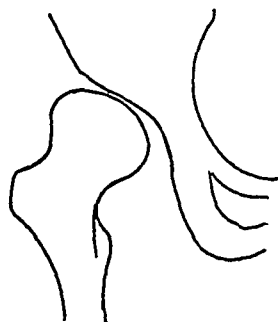


Fig 3

if the factor "less narrow" had been the most important, but this was, consequently, not the case

As we see, it is, throughout, elder persons in general who have been operated, so that, as a matter of course, I have had a number of complications, but, as will be seen by what I have said in the preceding pages, there have been no deaths. There have been 4 cases of thrombosis in vena femoralis, and 3 of thrombo-embolia, one of which was a very large lung-embolus. In one of my first cases I had an evident and rather troublesome paresis of m quadriceps. The nerve-branch from n femoralis comes from the median side and runs transversely of the direction of the section, a little below trochanter minor. One must be careful to observe this. — On one occasion, I had a serious case of infection.

As regards treatment after the operation, I allowed my first 20—25 patients — in accordance with the directions given by SMITH-PETERSEN, to leave their beds on the 12 th or 15 th day after, but I got the impression that this was too soon, and now I let them stay in bed for 3 weeks. From the 5 th day they are carefully given passive movements, and they are given massage from the 12 th day, together with passive and active exercises.

In about one-third of the cases, I have once or twice been obliged to carry out *débridement forcé* in evipan narcosis.

In this connection, on one occasion, during a bilateral operation I have had *fractura colli femoris* on both sides without my feeling it with certainty. Roentgen examination showed no dislocation. I let her stay in bed for 4 weeks, after which careful movements were begun, and she was allowed to leave her bed after 6 weeks. Now, 2 years later, she walks about without difficulty,

has less pains and mobility in the hip and is somewhat better than before the operation

One patient, a woman 39 years of age, was quite well for 2 years, then she began to feel pains and during the course of 2 years, flexion was no more than  $10^{\circ}$ . There had arisen a severe new growth of bone in the newly-fashioned articular capsule. She was operated once more and, on this occasion, I employed the Smith Petersen cup. Now,  $1\frac{1}{2}$  year after the operation, she is free from pain and the flexion is  $80^{\circ}$ . I may remark in parenthesis that she is the only one of my 6 cases of arthroplasty with vitaliumcup with whom I am entirely satisfied. The other patients have pains and their mobility is not specially good. 2 patients have had children  $1\frac{1}{2}$  and 4 years, respectively, after the operation. Both have grown worse afterwards.

As mentioned above, pains are the chief indication for operation. Now, it turns out that it is the 4th and 5th lumbar root that send sensory branches to the hip-joint.

By cutting through the sensitive part of these two roots intraspinally, we should be able to render the joint indifferent to pain, and we have done this at the Orthopaedic Clinic, Oslo, where my reserve physician dr. Rovig has carried out the operation on 3 of my patients where pain continued after resection of acetabulum. The result was very good in 2 cases.

### Summary.

The author has carried out control investigations of 73 patients, on whom he has performed resection of *acetabulum*, according to Smith-Petersen, for deforming alterations in the hip-joint. This was more than one year and a half ago. He has operated 79 hip-joints of these patients. On being questioned, 52 patients (71.2 %) replied that they were improved, and satisfied with the result. By this palliative operation, 38 % have been rendered free from pain, and 66 % have gained increased mobility. With an observation-period varying between 3 to 7 years, there are 43 patients, and of these 13 (28 %) are not improved. With an observation-period of from 3 to 1 year, there are 30 patients, 8 of whom (27 %) are not improved. When improvement has occurred it has remained permanent, otherwise the elder group would have displayed a worse result than the younger one.

### Zusammenfassung

Verf hat eine Nachuntersuchung an 73 Kranken angestellt, an denen er vor über  $1\frac{1}{2}$  Jahren wegen deformierender Veränderungen im Hüftgelenk eine Resektion nach Smith-Petersen am Azetabulum vorgenommen hatte. Er hat an diesen Patienten 79 Hüftgelenke operiert. Auf Anfrage haben 52 Patienten geantwortet, dass sie gebessert und mit dem Ergebnis zufrieden sind (71,2 % Erfolge). Durch diesen palliativen Eingriff wurden 38 % schmerzfrei, und 66 % bekamen bessere Beweglichkeit. 43 Patienten hatten eine Beobachtungsdauer von 3—7 Jahren, und von diesen waren 13 nicht gebessert (= 28 %). Bei 30 Kranken war die Beobachtungszeit 1—3 Jahre, und von diesen waren 8 (= 27 %) nicht gebessert. Wenn Besserung eintrat, war diese eine dauernde, andernfalls hatte die ältere Gruppe schlechtere Ergebnisse gezeigt als die jüngere.

### Résumé.

L'auteur a fait un examen complémentaire de 73 malades, auxquels il a performé resection de l'acetabulum selon SMITH-PETERSEN à cause d'altérations déformantes de la hanche. Il a opéré 79 hanches sur ces malades. A l'interrogation 52 malades ont répondu, qu'ils sont un peu améliorés et satisfaits du résultat (71,2 % bon résultat). Cette intervention palliative a rendu 38 % sans douleur et la mobilité a augmenté chez 66 %. 43 malades ont un temps d'observation de 7 à 3 ans et de ceux-ci 13 ne sont pas améliorés. 30 malades ont un temps d'observation de 3 à 1 an, et de ceux-ci 8 ne sont pas améliorés (27 %). Dans les cas, où il y a eu une amélioration, celle-ci a été permanente, si non le groupe le plus âgé aurait donné pire résultat que le plus jeune.

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## Some Cases of Ureter Implantation into Colon according to Coffey.

By

GUSTAF SODERLUND

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Although the operation of implantation of ureter into the intestine has gradually come to be employed not only in the treatment of ectopia vesicae but also in a large number of other morbid conditions, still, from the beginning, the method was chiefly intended to form a link in the surgical treatment of that severe congenital morbid condition which ectopia vesicae is. Consequently, in order that the method, to be dealt with here, of ureteral implantation, preferably into rectum or into colon pelvinum, may be viewed in its true light, it seems suitable to give, first of all, a brief account of the most important methods of operation earlier employed in this affection.

The methods which have at all been adopted in the treatment of ectopia vesicae may be divided into

1) Autoplastic operations, with covering of the vesical defect by means of flaps of skin or mucous membrane,

2) the procedure intended, by means of an operation on the pelvic skeleton, to bring the pubic bones nearer to each other to such a degree that it would thereby become possible to mobilize the edges of the vesica and so create a new urinary bladder, and finally

3) the methods which aimed at carrying off the urine in some other direction, to the intestine above all, and to follow this by extirpation of the ectopic urinary bladder

As early as 1841, attempts were made to cover the bladder defect with plastic skin flaps, and by this means create a new bladder. Probably, this method was first employed by WATT-

MAN It was afterwards improved by a number of surgeons, such as NÉLATON, ROUX, LANGENBECK, and others. In general, the results were depressing, even in the relatively few cases where the final result was fairly satisfactory, it proved necessary to carry out a large number of operations during the course of years. BILLROTH, in one case, carried out no less than 19 different operations on one and the same patient. It is deserving of mention, however, that in some few instances such plastic operations succeeded in getting all the urine to run off through the newly created urethra, drop by drop, with the patient in a standing position. In a prostrate position, a certain quantity, in one case, up to as much as 500 cc. could be retained in the bladder and then evacuated in a powerful ray. WINSLOW had the opportunity of examining a female patient who had been operated according to a method of WOOD's. This woman had afterwards gone through four normal partus, with healthy children. These few isolated successful cases are chiefly of historical interest. In the incomparably greater number of cases which had been operated with skin- or mucous-membrane plastics, either the patients died under the treatment, or the results were bad or only moderately good and with urinary fistulas remaining.

TRENDELENBURG was the first who succeeded, by means of bilateral chiselling of synchondrosis sacro-iliaca, and then pressing together the pelvis, in bringing the pubic bones together, and afterwards, as the next step, in refreshing the bladder edges and sewing them together. By means of this difficult method it was possible, in a few cases, to obtain even normal urinary evacuation conditions. But the operation-mortality was high, however, in the most favourable statistics being 22 %, and the results in general bad. It is deserving of remark, however, that TRENDELENBURG himself lost no patient by this operation. TRENDELENBURG writes, too, that he regrets that persons had been contented to employ imperfect substitutes — he is thinking here especially of MAYDL's operation, to which I shall return — and had abstained from further attempts to attain the ideal, viz., an urinary bladder functioning normally. TRENDELENBURG hopes, however, that, in the future, a return will be made to the path he had pointed out. This has not been done, however, but the method called by TRENDELENBURG an imperfect substitute, that, viz., which directs the urine to the intestine, has instead been transformed, and developed more and more.

The older methods, practised in our own days also, however, which aimed, above all, in cases of severe tuberculous morbid conditions in the bladder, but also in ectopia vesicae, at carrying one of the ureters, or possibly both, out through the skin in the back or in the groin, thus putting the urinary bladder out of function, are now, probably, generally entirely out of use, in ectopia of the bladder, at least. By the employment of this method in ectopia vesicae, uncomplicated in other respects, scarcely anything else is gained, too, than that the patient becomes wet at another part of the skin than that where the open urinary bladder lies. On the other hand, the method may be considered as still employable in cases of cancer or tuberculosis of the bladder, for instance, where the patient's affection is such that he has only a few months more to live, but where, at the same time, painful and frequent tenesmi make the invalid's existence unbearable.

The first operation aiming at establishing communication between the ureter and rectum, thus conducting the urine to the latter, and making the patient dry, and also bringing about complete continence, was carried out in 1851 by Sir JOHN SIMON at St Thomas' Hospital, London. He established a fistula between the ureter and rectum by means of sewing fast ureter to the rectal wall, and with the help of a specially contrived instrument, made a ligature through the lumina of both ureter and rectum, so that, gradually, communication was established between the two organs.

The operation was not altogether successful. It is true that a part of the urine ran off into the intestine, but a part continued to pass off through the uretral orifice. The patient, a boy of 13, died a year later, and, on obduction, it was found that the ureters were obstructed by stones, and that both kidneys were seriously injured. As NITCH, especially, points out, it is very interesting to note that COFFEY's latest published technique, the so-called Coffey III, in principle very closely resembles the operation described by SIMON about 90 years ago.

The first really employable method of procedure for the implantation of the ureters was that published by MAYDL in 1892. At an earlier date, various investigators had carried out implantation of the ureters into the intestine, sometimes in man (REIN and DUPLAY) and sometimes in animals (inter alia, by TUFFIER). In these instances, the ureters had been sewn direct into the

intestine, and the results, in general, were bad, the ureters becoming stenotic, with hydronephrosis and ascending infection developing in the kidneys

TUFFIER also expresses the opinion that, to avoid strictures and for the protection of the kidneys, the ureters should be implanted into the intestine *together with their adjoining vesical entrance parts*. In the spring of 1892, MAYDL operated a case of ectopia vesicae in accordance with the principle published by TUFFIER. In order to retain the normal surroundings of the ureteral exit, he extirpated all the urinary bladder with the exception of a little elliptical piece embracing trigonum and the ureteral mouths. After flexura sigmoidea had been drawn forward and opened lengthwise, there was inserted into the slit the remainder of the bladder together with the two ureters by means of sewing first the intestinal mucous membrane to that of the bladder, and then the cystic musculature to the musculo-serosa of the intestine. By the implantation of the ureters with this trigonal mucous membrane, there was retained, as regards the ureters, the narrow passage through the bladder-wall with its sphincter apparatus. The method was intended to prevent the rise of stenosis in the implanted ureter, and also to diminish the risk of an ascending infection.

By means of this method, ureteral stenosis was successfully avoided but on the other hand, ascending infection could not be eliminated. Still, this latter did not present itself as frequently as before, and usually not until after a rather long period of time. Operation-mortality with this method of MAYDL's, was fairly great however 22—33 %.

The numerous modifications of MAYDL's method of procedure, which were published later on, have aimed at diminishing, if possible, *the risk of the ascending infection of the kidneys*. BORELIUS-BERGLUND's method consists of making a lateral anastomosis to the evacuating leg of flexura sigmoideae, and then implanting the bladder-bottom in the very cupola of this coil. The condition necessary for the employment of this modification is of course, that the intestinal coil is sufficiently mobile.

MILLER, ENDERLEN, MULLER, FLORCKEN have modified MAYDL's operation thus they have divided flexura sigmoidea, sewn the oral end, end to side, far down on rectum and afterwards implanted the ureters into the thus formed blind sac of the distal end of rectum. In one of my cases, to which I shall return later on,

this operation had earlier been performed by FALTIN. An interesting and, theoretically, well-founded method which, at one and the same time, aimed at diminishing the risk of an ascending infection towards the kidneys by forming a part of the intestine, excluded from the faeces, into an implantation-place for the ureters, and also at creating such a state of things that the urine and the feces would not be mingled, has been published by GERSUNY. GERSUNY divided rectum at colon descendens, and then implanted the ureters into rectum, after which the central part of the intestine was drawn down through the sphincter, where its intestinal membrane was attached to the skin. Finally, among the very great number of operation-methods which have been employed in ectopia vesicae, there should be mentioned MAKKA's operation, which consisted of forming a new urinary bladder out of a part of the intestine. In the first séance, caecum is secluded from the other part of the intestine, after which, eventually, the future urinary bladder is sluiced for a long time through the exposed appendix. Then the bladder-bottom is implanted into coecum, after which the urine is carried off through the appendix. Naturally, the patients operated in this way must constantly employ a catheter. In order to avoid this, ROLOFF has sewn appendix into rectum, a method, however, which can be employed only under certain conditions.

As already mentioned, MAYDL may be said to be the first to introduce a relatively employable method in the treatment of ectopia vesicae, and for a number of years in succession, his method of operating ectopia vesicae has been the one most frequently employed, above all in Germany and elsewhere on the continent in general, and also in Sweden.

The next advance in ureter implantation into the intestine after MAYDL's was made by a Swedish surgeon, BERGENHEM from Nyköping, who published his method in 1894. BERGENHEM was probably the first to implant separately into the intestine each ureter with its orificial part. Possibly, he was also the first who carried out the implantation extraperitoneally. When performing this operation, he cut out each ureter from the bladder-bottom, together with a little rosette of bladder-coil around it, the normal orifice-valve being thus retained. The patient on whom this operation was carried out was suffering from an adenoma which had arisen from an ectopic bladder. First of all, the tumour was removed, a little later, there was excised the bladder-wall with the



exception of two small oval sections which were allowed to remain, one around each ureteral orifice. It was BERGENHEM's intention to work exclusively exteriorly of peritoneum. By mistake, peritoneum was opened twice but the opening was at once sewn together again. After the ureters had been released extraperitoneally, rectum was exposed by a transversal section in peritoneum, and through this opening, the ureters were implanted into the rectal wall, thus with the ureteral orifices attached.

It is, above all, KIRWIN who in a memoir (1930) in the *American Journal of Surgeons* sharply pointed out that the honour of being the first to have the idea of transplanting the ureteral orifices intact and individually into the intestine must be assigned to BERGENHEM. The operation has afterwards been carried out, in accordance with the Swedish surgeon's publication, by POZZA (Italy), and FRANKLIN H. MARTIN (U.S.A.) in 1898, and by GEORGE A. PETERS (Canada) in 1899, and KIRWIN points out that, probably on account of the journal "Eira", in which BERGENHEM first published his case, being practically unknown to English-speaking surgeons, the name of PETERS was given to the method in the U.S.A., Canada and England, while in Italy it was called POZZA's. It is clear, however, that BERGENHEM was its inventor, as his work preceded PETERS' publication by almost five years. PETERS described his operation in the *British Medical Journal*, 22 6 1901, and it is evident that then he was not acquainted with BERGENHEM's contribution. In 1909 BERGENHEM's method was again employed, this time in Pittsburg by BUCHANAN. In the same year, too, there is mentioned for the first time COFFEY's published method which, later on, caused such great excitement and which is still called by his name. BUCHANAN compared the mortality attendant on MAYDL's operation and that accompanying the method by which the ureters are implanted separately, i.e., in accordance with BERGENHEM. He pointed out that the implantation of the ureters separately led in every way to the same goal as that aimed at by the implantation of the whole trigonum, both as regards the assuring of a blood-supply and the protection of the ureteral mouth against ascending infection. BUCHANAN also stated that of 80 patients operated according to MAYDL, 23 had died, a mortality of 28.7 %, while, of 26 operated according to BERGENHEM's technique, only 3 had died. From this, BUCHANAN deduces that BERGENHEM's method is to be preferred.

In this connection, there should, perhaps, be mentioned KRYNSKI — who, like MARTIN, placed the ureter far into the wall of the intestine, similarly to the vesical course of the ureter — and also FOWLER who, in 1898 created a little mucous-membrane valve of rectal mucous membrane for the purpose of protecting the uretral orifice from contact with feces. In 1907, Sir HAROLD STILES introduced his so-called "semi-oblique method" which led to evident success, as five of his cases lived in good health, 6, 9, 15 and 20 years after operation. STILES' method was as follows: the ureter is divided as far downwards as possible, the end is cut obliquely, and into this there is knotted a cat-gut thread. Afterwards through a transversal cut, an opening is made into the intestine, and here there is introduced the uretral end which is made fast by a suture through the intestinal wall. Then follow ordinary serosal sutures. STILES' method, consequently, is principally, the same as that employed in the formation of a Witzel fistula.

In 1930, that prominent surgeon G. GRAY TURNER from Newcastle, communicated 17 cases of ureter implantation into rectum, carried out during the years 1912—1927. In every instance, the operation had been performed on account of ectopia vesicae with, or without, congenital defects of the urethra. In most of the cases, the operation had been carried out according to STILES' method, sometimes in agreement with PETERS'. In GRAY TURNER's material, 4 patients had died in direct connection with the operation. The survivals had enjoyed good health for 1½ to 15 years after it.

While the methods published by MAYDL, BERGENHEM and PETERS for the implantation of the ureter into colon were based on the retention of the oral area of the uretral entrance into the bladder, thereby preserving the natural protection of the ureter against an ascending infection, KRYNSKI, MARTIN, FOWLER, STILES and others have divided the ureter before its entrance into the bladder and then have implanted the ureter into colon but, when making the implantation, have endeavoured to create an artificial valve-device for the prevention of an ascending infection.

All the methods published by these authors are, consequently, to be considered as the precursory steps of the operation-method of implanting ureter into colon to which COFFEY's name has been given, and which, during the last few decades, has probably been more extensively employed than any other method.

It seems clear, then, that there existed an urgent desire to obtain a method of implanting the ureters into colon without their being accompanied by pieces of the bladder, and this out of consideration for the cases, especially, of malign tumours of the bladder, where extirpation, *in toto*, of the urinary bladder was indicated

The experimental investigations which gradually led to the development of COFFEY's method were begun by COFFEY as early as 1908, after he had been urged to do so by Dr W J MAYO. Stimulated by MAYO, COFFEY studied first the implantation of ductus choledochus into duodenum. When doing so, he observed that there always succeeded to a direct implantation of ductus choledochus into the intestine of animals a considerable dilatation of the duct, and he ascribed this dilatation to what he terms the *intraintestinal pressure*. COFFEY made the deduction that the normal course of the duct is that between the mucous membrane and the musculature, was an important device of Nature's to prevent the pressure in the intestine from exercising an injurious influence upwards in the duct. In 1909, COFFEY began, in experimental implantations of the ureter into colon of dog, to apply the same principle, i e., to allow the ureter to pass some cm between the mucous membrane and the muscular tube before entering into the lumen of the colon. He hoped in this way to be able to prevent the rapid enlargement of the kidney which could previously be observed in a great number of cases, in experiments of animals above all, but also in *man*, in direct implantation of the ureter into the intestine. The method was described by COFFEY in 1911, and he himself states that in 1912, CHARLES MAYO, carried out for the first time in man an implantation of the ureter in accordance with this method. This, however, was probably not quite correct. In 1911, MIDDLETON had operated a 17 years old patient for ectopia of the bladder, shortly after COFFEY had published his experiments on dog, and exactly in accordance with the method stated by COFFEY for the ureter-implantation into colon. Late investigations (1937) show that the patient could retain the urine the whole night, and for 4—5 hours during the day. The patient in question now is married. After extirpation of the bladder, his epispadias was operated, and he has two healthy children. The intravenous pyelography exhibits 2 normal kidneys. The operation was carried out 13 1911. In January, 1911, he had been operated in accordance with PETERS but con-

tinued to have an urinary fistula On 13 1911, he was operated bilaterally in accordance with COFFEY's technic I in a single séance

During the first 17 years after the appearance of COFFEY's method, there were operated at the Mayo Clinic 76 cases of ectopia vesicae, the ureter-implantation in all these cases being carried out in agreement with the above-mentioned principles given by COFFEY In 1931 WALTMAN WALTERS gave a survey of these 76 cases in the Deutsche Gesellschaft fur chirurgie It can be said that the primary results were very good, the operation-mortality amounting to no more than 3.9 % as, of the 76 cases, only 3 died in connection with the operation 59 patients could be examined at a later date WALTERS, at the time, showed that 27 were still living 5 years after the operation, and 13 were in life 10 years later Unsatisfactory results were observed in only 3 cases In no less than 50 % of the cases investigated there had not been observed any signs of renal affection and in 21 % of the cases there were merely observed short periods of a slight renal affection The length of time between such periods was, in most instances, many months and sometimes years The investigation of the functioning of the kidneys in a number of cases, by means, above all of urography, also showed that their function was normal and that there had not arisen any expansion of the renal pelvis calyces or ureters

It is deserving of attention that in all the cases in this great series of ureter-implantations carried out by COFFEY at the Mayo-clinic it was a question of patients with ectopia vesicae, and that in the great majority of cases the patients were young who, on operation, displayed, in general, uninjured kidneys

All the patients, consequently, were operated according to COFFEY's principle This method, in accordance with what has been stated of it above, consists of the ureter being allowed to run in the intestinal wall 2 to 3 cm submucously, after which the end of the ureter is carried into an opening in the mucous membrane at the caudal end and is anchored on the inner side of the intestine, and has, in the literature, been termed ureter-implantation according to MAYO-COFFEY, or *Coffey's method n o 1* It is of a certain interest that, as late as 1913, CHARLES MAYO emphasized that the carrying of the urine into the large intestine is not to be recommended as, in consequence of the disintegration of the urine in the intestine, intoxication can easily arise

In those cases where the bladder must be disconnected, MAYNARD prefers to conduct the urine to the skin of the back above the crista ili.

In 1929, CORFEY published 20 cases of ureter implantation into the colon operated in accordance with a somewhat different technique, the so-called CORFEY's method no II. In accordance with this method, too, the ureter is implanted into the rectum in the same way as in CORFEY I, but with the following modifications of the method of procedure: after the rectum has been carefully evacuated and, eventually, lavaged, before the operation, it is filled all the way up to the colon pelvinum with gauze tamponade. After the ureter has been divided and ligated near the bladder, there is introduced into the former an ureter-catheter. After this the section in the intestine is carried in the usual way into the mucous membrane. Then a corner of the above-mentioned tamponade is drawn out through a little hole in the mucous membrane, and to this corner there is sewn fast the ureter-catheter. Then the tamponade is drawn out, in which process the ureter-catheter gradually comes with it. The tamponade is drawn out so far that the ureter can lie, to a suitable extent, submucously in the intestinal wall. Then the inserted ureter-catheter is fixed with two rows of sutures. By means of this method there is gained *inter alia* the advantage — emphasized by CORFEY — that there will arise no risk of any occasional or constant propping of the ureter at its entrance into the intestine, but the urine can at once run off through the inserted ureter. In CORFEY's 20 cases published in 1929 operated according to this method, there has not, CORFEY writes, been observed any evident sign of general post-operative renal infection or peritonitis. CORFEY himself ascribes great importance to the firm anchoring of the ureter in the wall, obtained by means of the ureter-catheter, for the avoidance of peritonitis or local infections at the place of implantation. CORFEY points out in the same publication (1929) that he now considers this operation principally ready, and that it is employable in all the conditions in which it is necessary or advisable to do without the bladder as the reservoir for the urine. He gives the following conditions in which the employment of the method appears justified:

- 1) ectopia vesicae,
- 2) incurable cancer of the bladder where one can expect the patient to live more than 6 months, and where morphine or palliative cystostomy is indicated,

3) certain cases of early extirpation of carcinoma of the bladder when it is well understood that the cancer has such a position or extension that a total extirpation of the bladder appears to be indicated

To this group, perhaps, there ought also to be referred those cases of extended papillomatosis of the bladder where, it is true, an histologically determined cancer is not present, but where the papillomatous extension in the bladder is such that its elimination is excluded without a removal *in toto* of the bladder

4) Incurable tuberculosis of the bladder, where one kidney has been extirpated and the other is free from tuberculosis,

5) certain cases of tuberculosis in prostata and seminal cysts, with or without perineal fistulae,

6) incurable vesicovaginal fistulae,

7) extensive incurable multiple fistulae in perineum, originating from various diseases,

8) certain cases of painful shrunken bladder, caused by infections of various kinds,

9) injuries to the urinary apparatus caused by trauma, which make it impossible to employ the bladder

COFFEY's method n o III was described in March 1930 and was probably created to diminish the risk of infection at the implantation-place. The method is carried out thus: after the ureter has been divided in the usual way, it is ligated at the distal end and is laid in the ordinary way against the mucous membrane which, however, in this method, is not opened. Then a suture is inserted right through the ureter and in through the intestinal mucous membrane which is knotted, whereby, consequently, the ureteral wall and the mucous membrane become knotted close to each other. Here, when the suture has cut through, there gradually arises a connection between the ureter and the intestine. COFFEY himself has great expectations of this method of his. In the experimental operations on dog, which he carried out, the result with this method has been much better than with any other. In all the cases, the sutures had cut through and created an anastomosis. Peritonitis had not occurred in any instance. Instead of becoming sick the day after the operation, as has occurred in operations on dog according to COFFEY I and COFFEY II, the dogs had become playful within 2 or 3 days and scarcely showed any sign that they had gone through an operation. The immediate and later results on animals had been excellent. The

aperture between the ureter and the intestine had subsisted even several months after the operation

In 1932, COFFEY published 3 cases of ectopia vesicae operated according to method III. The children were respectively 8 months, 20 months and 2 years and 9 months old. In one of the cases, the intestine was opened through carelessness in the operation, thus brought about urinary fistula. In the two other cases, the course was free from complications. COFFEY considers that Technic no III should be the normal treatment for ectopia vesicae in little children. As the cutting through by the sutures and the establishment of the desired fistula between the ureter and the intestine according to COFFEY III can take a period of 2 to 3 days, it is evident that bilateral implantation of the ureter cannot be carried out with this method in a single seance. Three dogs on which bilateral implantation had been carried out, all died within 48 hours.

Of course, this method cannot be employed when only one uninjured kidney exists, nor, as a matter of course, with expanded ureters and kidneys injured before the operation.

It would seem, however, as if COFFEY himself considered his method no II as the most reliable. None the less, says he this is a serious operation in the hands of anyone who is not well acquainted with the principles and details of abdominal- and intestinal surgery. Technic III is a far more reliable operation in the hands of one who is carrying out his first implantation.

Modifications of COFFEY's implantation-method have later on been worked out. As far as one can find, the most important of these is probably that published by HIGGINS. The method had been worked out by HIGGINS by experiments on dog, and was published in 1933. The ureter is isolated to a length of 8 cm and, as in COFFEY, there is made in the intestine an approximately 6 cm long incision through serosa and muscularis up to the mucous membrane. When doing this the intestinal lumen must not be opened under any circumstances. Then the ureter is placed against the intestinal mucous membrane, and a mattress-suture is laid through all the mural walls of the ureter, and then through the intestinal mucous membrane, and is knotted fast. Above this there are afterwards sewn the serosa-muscularis layers so that the urinal duct is made to lie within the intestinal wall for a length of from  $2\frac{1}{2}$  to 3 cm. The peritoneum of the posterior abdominal wall is sewn over the anastomosis, so that it is

made to lie extraperitoneally. The intravenous urography showed that after 12 hours, the urine emptied itself normally into the urinary bladder, while, after 48—50 hours, the evacuation took place into the intestine. As the new canal, i. e. the exit into the intestine, proved to function reliably, cystectomy was carried out. The urinal duct was ligatured doubly at the exit place from the intestine and the central end was inserted deeply into the intestinal wall.

HIGGINS communicates (1933) that he has carried out this operation with satisfactory results on 3 children with bladder-ectopia, 3 patients suffering from cancer of the bladder and 1 patient with vesicovaginal fistula. In 1935, HIGGINS communicates that he has employed his method in 53 cases in man, and with 4 deaths. With HIGGINS' method, both ureters can be implanted in one séance.

Later on, BRENZER has further modified HIGGINS' method. BRENZER's modification is, that he introduces metal rings into rectum. The thread which is to bring about connection between the ureter and the intestine is carried through the ureter in through the intestinal mucous membrane and catches the ring lying in the intestinal lumen, thus securing the rise of mural necrosis. To the ring there is attached a long thread which passes out through anus. BRENZER has also provided the ring with a metal wire which can be insulated by means of a thin rubber tube, after which diathermal burning-through of the wall can be carried out.

BRENZER communicates a large number of cases operated by him with success in this manner.

A close examination of the literature from the period about 1912, when COFFEY's method first began to be employed, and up to the present day, appears to show that the hopes attached to the Coffey-method in the treatment of ectopia vesicae have been well fulfilled.

It is also deserving of mention that, in the main, ureter-implantation into colon has chiefly been employed in Anglo-Saxon countries, chiefly in America but also in England. It has further been employed in Russia, where, during the last few decades a large number of such operations has been made.

SMITTEN, the Russian surgeon, for instance, as early as 1923 made a survey of no less than 318 cases of ureter-implantation into the intestine. In this survey there had not been included operations according to MAYDL. Of the 318 cases 200 were said



to have recovered, and 116 had died. The most usual cause of death was stated to be peritonitis. In these cases, the ureters had mostly been implanted into colon in accordance with STILFS.

But it is American surgeons above all who, in a large number of publications during the last 20 years, have published their results of ureter-implantation into the intestine. All of them appear to be united in the opinion that ureter-implantation into the intestine, according to COFFEY, should be the normal method in the treatment of ectopia vesicae and, on the whole, in all the cases of surgical affections where, for various reasons, the bladder needs to be removed. At the same time, however, it is emphasized in various quarters that no existing method of ureter-implantation is an ideal one, partly on account of the complications — peritonitis above all — now and then occurring in connection with the operation, and arising at the place of implantation, partly, and above all, on account of the ascending infection of the kidney.

The American surgeon, HINMAN, summarized in 1937 experiences from America respecting ureter implantations into the intestine. HINMAN points out that, in the literature, there are no less than some 60 methods or modifications of procedure. He gives a warning against all implantations into intestinal parts which are completely or partially disconnected, or into artificial urinal bladders or blind-sac formations, as being unsuitable on account of their not affording protection against urinary-path infection, but which are probably rather calculated to favour the rise of such affections. The primary mortality, too, is high with these methods of procedure being between 40—50 %. Implantations in the unaltered intestine can, says HINMAN, be referred to 11 technic fundamental forms. Altogether, 740 patients have been treated by, essentially, only 3 methods of operation.

1) With formation of a muscle-coil or WITZEL's fistula (MARTIN, KRYNSKI, and others). To this group belong 136 cases with a mortality of 28 %.

2) Implantation of the ureter-mouth, according to MAYDL or BERGENHEM. 243 cases with an equally great mortality.

3) The submucous implantation according to MAYO-CORRIG. 259 cases with a mortality of 30 %. In altogether 203 cases of malign tumours, the mortality exceeded 50 %, of 190 patients with ectopia of the bladder, vesicovaginal fistulae, incurable wounds (of the bladder) or infections 20 %. The most important

complications are peritonitis which has appeared in 82 cases, ileus in 24 cases, urinal- and intestinal fistulas in 72 cases. In 212 cases there appeared early infections of the kidney or kidneys, and in 54 cases there arose stenosis of the ureter.

The final results, says HINMAN, cannot be determined. The submucous method of procedure is the best. The modifications worked out by HIGGINS and others, which, like COFFEY's technic III are based on a connection that gradually arises between the ureter and the intestine are not yet sufficiently elaborated. *As a matter of fact, says HINMAN, the problem of the implantation of the ureter into colon must, even to-day, be considered as unsolved.* HINMAN also emphasizes that the question is not a purely technical one. The rise of urogenous sepsis is an incalculable factor.

This opinion of HINMAN's is, most certainly, on the whole, correct. First, as regards operation-complications it may probably be asserted, however, that, above all, the great series of cases of ectopia vesicae operated according to COFFEY at the MAYO clinic, show that with proper technical skill, these complications can be kept at a low level, and that it has not been possible to determine with security the existence of any demonstrable difference between extra- and intra-peritoneal implantation. On the other hand, however, HINMAN's survey shows that the number of cases of peritonitis arising from the place of implantation is so far great that modifications of COFFEY's procedure, calculated to diminish the risk of the rise of inflammatory processes at the place of implantation would appear to be welcome. Perhaps, too, the question of extra-peritoneal operation as first given by BERGENHEM ought to be the subject of renewed discussion.

It is strange, that in Germany, ureter implantation into the intestine seems on the whole to have been employed only to a very slight extent. Although COFFEY's various methods of operation have been described very exactly in German hand- and other medical books, the method does not seem to have gained any foothold worth mentioning in Germany nor are the results published by a few German authors encouraging.

In Sweden, ureter implantation into colon has, as yet been employed only in relatively few cases although in an ever increasing number. GUNNAR NYSTROM who in 1933 communicated 3 cases of ectopia vesicae treated in this manner, was probably the first in this country who employed the method. In 1939, HELL-

STROM published an interesting case of epispadias which he had an opportunity of examining afterwards. Here in Sweden, the method has also been employed by, *inter alia* STROMBECK, CRAAFORD and HINDMARSH. From Norway and Finland I have not been able to discover in the literature any case operated according to COFFEY. From Denmark, S. A. HANSEN communicated in 1936 a case of ectopia vesicae successfully treated and operated according to COFFLY-HIGGINS' method. The case was that of an 8-year old girl who was operated typically according to HIGGINS but with the not altogether unimportant modification, that HANSEN inserted up into rectum a rubber-drain which was clasped by a suture passing through the uretral wall and the intestinal mucous membrane. On the fourth day the rubber-drain in rectum was removed by a slight pulling, and then the two transfixing threads were seen lying on it. Both ureters were implanted at the same time. In new séances, there were then removed the bladder and the ureters, and the patient could be discharged as well cured, with a fixed and satisfactory abdominal wall, and with all wounds healed. In addition there was made a slight plastic operation, whereby introitus vaginae was given a natural shape.

Finally, I should like to add some words to this survey of ureter implantations according to COFFEY, calculated to show that, in ectopia vesicae especially, the method, however, gives such good results, even as regards the period succeeding the operation, that a no slight number of female patients, operated typically according to COFFEY, have been able to marry, go through normal deliveries and have healthy children. RANDALL and HARWICK communicate 1934 that 145 patients with ectopia vesicae were treated at the Mayo-clinic during the 20-years' period 1912—1932. Of these, 35 were woman, and 28 underwent bilateral implantation of the ureters into sigmoideum. 5 of these 28 have married, and 4 of them have got children. A survey of the literature at the time (1934) shows that no less than 28 children have been born of 20 women who had been operated for ectopia vesicae according to COFFEY.

In the following pages I shall give a short account of 16 cases operated by the author according to COFFEY during the period 25 10 1932—27 2 1944. 15 of these cases have been operated at the Surgical Clinic of the Seraphimer Hospital and 1 at the Sophia Home, Stockholm.

## Casuistics.

I. *Ectopia vesicae urinariae*

4 cases (1—4) 0 deaths

*Case 1* Boy, 6 years old Diagnosis *Ectopia vesicae urinariae*History of case congenital malformation Attended at the surgical clinic of the Seraphimer hospital  $21/4-1/7$  1934 and  $14/2-29/8$  1935

On admission, good general condition

 $23/5$  1934 Implantation of the right ureter into colon according to COFFEY II $11/6$  1934 Implantation of the left ureter into colon according to COFFEY I $8/3$  1935 Extirpation of the urinary bladder $1/4$  Radical operation of inguinal herniaHe was discharged cured  $29/1$  1935

Condition dry during day, usually dry at night too, evacuation of intest 3—4 times by day, once or twice nightly

Subsequent examination autumn 1942 very good general condition, works in stable and farmyard, not always dry at night, as he does not wake

*Case 2* Girl, 2 years old Diagnosis *Ectopia vesicae urinariae + Defectus vaginae*History of Case congenital malformation Attended at the Surgical Clinic of the Seraphimer Hospital  $13/9-14/12$  1939 and  $29/2-3/6$  1940

On admission, good general condition, the skin around the ectopic bladder greatly transformed eczematously Kidneys the urographic displays normal secretion Operation put off on account of stubborn bronchitis

 $24/11$  Implantation of both ureters into colon according to COFFEY II Uterus and adnex normal Subsequent course without remark Discharged  $14/12$  1939 Readmitted  $29/2$  1940 $8/4$  1940 Extirpation of urinary bladder + radical operation of abdominal hernia On suturing the abdominal wall, there was opened, in the neighbourhood of symphysis, a cystic formation lying immediately under the skin and as large as a Spanish nut, which, on continued investigation, proved to consist of a vagina, normal in other respects, which, consequently, could be placed in its normal positionShe was discharged cured  $3/6$  1940

Subsequent examination, autumn 1942 Excellent general condition evacuates intestine as a rule twice nightly and 3—4 times by day keeps herself dry

*Case 3* Youth 18 years old Diagnosis *Epispadia totalis c ectopia vesicae*,

History of Case born with a total epispadia The opening to the bladder seems, however, to have been very small Pat could not at all retain urine, which ran out on the stomach At the age of 10 admitted to the Vasterås hospital where, during 1925, submitted to, in all, 6 plastic operations by means of which the channel could gradually be

## Implantation of

No	Sex and Age	Illness	Day of operation
I Dead in connection with operation			
14	Man, 26 years	Tuberculosis renum ambor, prostatae et vesicul seminal + fistulae urin region rad penis	Coffey II dext 1/10 1932
7	Man, 67 years	Papillomata vesicae urinar malign	Coffey II sin 18/10 1937
8	Man, 72 years	Diffuse bladder papillomatos	Coffey II bilat 1/9 1939
16	Woman, 50 years	Radium treated cancer uteri + Fistulae vesico et recto vaginal region sacral	Coffey I into caecum 4/6 1942
II Patient discharged			
1	Boy, 6 years	Ectopia vesicae urinar	1) Coffey II 3/9 1934 2) Coffey I 15/6 1934 3) Ext of bladder 8/3 1935
2	Girl, 2 years	Ectopia vesicae urinar	1) Coffey II bilat 4/11 1939 2) Ext of bladder 8/4 1940
3	Man, 18 years	Ectopia vesicae urinar + Epispadia	1) Coffey II right 1/5 1934 2) Coffey I left 13/6 1934
4	Man, 18 years	Ectopia vesicae urinar + Epispadia	1) Explorative 1/9 1940 expos of bladder 2) Nephrectomia sin / 1940 3) Coffey II dext 14/6 1940 4) Extirp of bladder 7/9 1940
5	Woman, 57 years	Cancer vesicae urinar (in extirp)	Coffey II bilat 1/5 1941
6	Man, 56 years	Cancer vesicae urinar (in extirp)	Coffey II left 3/5 1943
9	Man, 53 years	Cancer vesicae urinar	1) Exploratio 21/5 1937 2) Coffey I sin 18/6 1937 3) Extirp of bladder 5/7 1937
10	Man, 71 years	Cancer vesicae urinar	1) Coffey II bilat 2/1 1939 2) Extirp of bladder 1/1 1939
11	Woman, 55 years	Cancer vesicae urinar Papillomata maligna vesicae urinar	1) Coffey II right 5/9 1941 2) Extirp of bladder 22/1 1941

## ureter into colon

Discharged	Day and cause of death	Remarks
	<sup>30</sup> / <sub>10</sub> Uraemia	Nephrectomy in Sept 1928 for tuberculosis remission. Section showed the also in r kidney
	<sup>22</sup> / <sub>10</sub> Peritonitis origin not elucidated	Bladder papilloma relapses with increased frequency since Sept 1936
	<sup>21</sup> / <sub>6</sub> Bronchopneumonia	"Knee" on r ureter w acute hydronephrosis and infection
	<sup>11</sup> / <sub>5</sub> Peritonitis originating at place of implantation, cancer quite healed	After anus praeternat at flex sigmoid at another hospital, pat better, in despan at min fistulae which make her an invalid
	Status on discharge	
<sup>1</sup> / <sub>7</sub> 1934	Dry dur day, usually dry at night too, evacuation of int test once or twice nightly	Subsequent exam Very good gen cond, works in stable and farmyard, not always dry at night, as he does not wake
<sup>11</sup> / <sub>11</sub> 1939	Good gen cond, cannot yet keep dry	Subsequent exam Very good gen cond, evac intest twice nightly, 3—4 times by day, keeping dry
<sup>3</sup> / <sub>3</sub> 1935	Good gen cond but tired Evac intest twice nightly, 4 times by day, sometimes attacks of pyelitis	Pat not found
<sup>26</sup> / <sub>9</sub> 1940	Good gen cond Evac intest once or twice nightly, 4—8 times by day	Well after discharge, has situation in Imatra, no pyelitis attacks or other real distress except not quite dry at night
<sup>13</sup> / <sub>6</sub> 1941	Fairly good gen cond but tired Evac intest 5—6 times daily	By operat free from terrible tenesmus. Died following year
<sup>4</sup> / <sub>6</sub> 1943	Considerably improved Happy at being free from frequent and painful tenesmus, but troubled by frequent fecal evacuations about once an hour	Died following year
<sup>20</sup> / <sub>7</sub> 1937	Good gen cond 2—3 evac nightly 2—3 by day	P A D Greatly infiltrating indifferent cancer Local relapse Nov 1937 Died 1938
<sup>8</sup> / <sub>1</sub> 1939	Good gen cond 1—2 evac nightly 4—5 by day	P A D Exfoliated epith cancer Well 3 years, then frequent urinations Dead acute pyelonephrit <sup>4</sup> / <sub>10</sub> 1942
	Fairly good gen cond Evac intest 2—3 times nightly, 3—4 times by day	Subsequent exam periodically very well, been up and has even been able to retain urine up to 6 hours by day In be

No	Sex and Age	Illnes	Day of operation
12	Man, 58 years	Cancer vesicae urinar	1) Coffey II right $\frac{8}{3}$ 1943 and left 2) Extirp of / 1943 bladder
13	Man, 46 years	Cancer vesicae urinar	1) Coffey II left $\frac{1}{1}$ 1943 2) Coffey II right $\frac{9}{1}$ 1944 3) Extirp of $\frac{3}{4}$ 1944 bladder
15	Man, 19 years	Tuberculosis vesicae urinar + Stricture urethrae tu bercul c fistulis perine et crenae ani	Coffey II left $\frac{1}{9}$ 1942

closed up to the root of penis. By this means his condition was considerably improved and he could retain his urine for a couple of hours. On miction, however, no proper ray was obtained, but the urine spread in different directions; he easily wetted himself, and drops fell pretty long afterwards. He himself considered his condition very unsatisfactory and earnestly wished something to be done. He was admitted to the Surgical Clinic of the Seraphimer hospital and attended there from  $\frac{8}{12}$  1933 to  $\frac{23}{3}$  1935. On  $\frac{11}{12}$  1933 there was made a bladder fistula; urine purulent, great numbers of staphylo- and streptococci and coli.

$\frac{8}{1}$  1934. Lambeau-plastic in order to try to cover the channel. Infection arose in the entire wound which must be debrided.

The wound rapidly became clean, but the bladder-capacity grew less and less, and the patient frequently suffered severe pains in the vicinity of the bladder. In consequence of very great concrement formation, in and about the catheter, it was difficult to keep the stream of urine flowing. In order to alleviate the patient's very considerable distress, it was finally decided to carry off the urine from the bladder according to Coffey.

$\frac{22}{5}$  1934. *implantation of right ureter into colon in accordance with Coffey II.* Subsequent course, on the whole, satisfactory.

$\frac{13}{6}$  1934. *implantation in the same way of left ureter but now in accordance with Coffey I.*

$\frac{21}{6}$  Urine and pus through operation-wound but general condition good. Non protein nitrogen 25 mgr %. During the weeks immediately afterwards, occasional urine-stream from operation wound, now and then temporary rise of temperature to  $39^{\circ}$ — $40^{\circ}$ .

$\frac{30}{9}$  Incision into operation wound on account of a sudden muscular tension. In a division of the peritoneal cavity circumscribed by adhesences, about 300 cc slightly turbid liquid not smelling like urine,

Discharged	Status on discharge	Remarks
<sup>30</sup> / <sub>6</sub> 1943	Gen cond good, evac intest 1—2 times nightly, 2—3 times by day	tween, severe pyelitic attacks with fever and rising "non protein nitrogen" Last year considerably improved Subsequent exam <sup>30</sup> / <sub>12</sub> 1943 Feels quite well, has lately made a fortnight's official journey in Norrland without distress
<sup>17</sup> / <sub>5</sub> 1944	Very good gen cond, lately made long promenades Evac intest 1—2 times nightly, 2—3 times by day	
<sup>17</sup> / <sub>10</sub> 1942	Gen cond good, evac intest once nightly, 2—3 times by day	Considerably impr by op, and so very happy, increased many kg in weight, perfectly dry, works full time as clerk

no fistula to intestine or ureter was observed, drainage The abdominal wound healed gradually, and the patient's condition improved during the next following months, but with temperature tops now and then, and shiverings, and aching in the neighbourhood of the right kidney — probably attacks of pyelitis On the whole, however, his condition improved and on his discharge, <sup>23</sup>/<sub>3</sub> 1935 was approximately as follows

He considers himself in better condition than he was at first, as he no longer experiences the severe urinal distress, and the old aching above the neighbourhood of the bladder has gone He keeps himself perfectly dry, he evacuates the intestine twice nightly and 4—5 times by day, without pain or other unpleasantness, His subjective condition, consequently, is good excepting in the respect that he feels fatigued

Case 4 Youth, 18 years old Diagnosis *Epispadia total, c ectopia vesicae ad mod MAYDL (MULLER-ENDERLEN) operat + Pyonephrosis renis sin c lithase*

History of Case remitted to the Surgical Clinic of the Seraphimer Hospital by Professor FALTIN who had operated him, taking several séances The first operation was carried out <sup>6</sup>/<sub>6</sub> 1930 There was then performed sigmoideo-rectostomy with section of the flexure, the sewing-in of the proximal end, end to side, into rectum, and the fixation of the blind closed upper intestinal end against the anterior abdominal wall On <sup>15</sup>/<sub>7</sub>, there was the next séance, when the greater part of the ectopic bladder was removed, and the bottom of the bladder with the ureter mouths were sewn into the rectum-stump which had been drawn forward and opened A fistula arose which, however, secreted only a relatively slight amount of urine, most of the urine ran off through anus The patient's condition was improved by these operations, so that he was able to go to school and take part in school-life,



without, to any amount worth mentioning, wetting his clothes in the neighbourhood of symphysis. Some years later an attempt was made to close the fistula, but without success and, instead after this operation, the fistula leaked more than before. He was admitted to the Surgical Clinic of the Seraphimer Hospital on 6/1 1940, was discharged healed on 26/9, the same year. On admission his condition was fairly depressed, he was thin, with a pale yellowish complexion afebrile, Non protein nitrogen 45 mgr %. A great amount of urine, probably the greatest amount, ran out through the fistula, the remainder through rectum.

16/4 Urogram centrally in left kidney, a large coral-stone filling the entire pelvis and the greater part of the calyces. No contrast secretion on left side. On right side secretion beginning in normal time, the calyces large and lumpy, and the pelvis slightly dilated.

17/5 *Exposure of the bladder-bottom with ureter-mouths sewn into the intestine.* There appeared no possibility of closing the fistula, thick, purulent, stinking urine from left ureter which was greatly thickened, clear urine from the right one.

27/5 Non protein nitrogen 36 mgr %

27/5 *Nephrectomia sin.* The kidney greatly enlarged, bluish-red, in the upper pole there were felt several caverns as large as walnuts, the ureter as thick as a finger, the caverns contained pus, not like the P. A. D. *Pyelonephritis with abscesses, not the* — Subsequent course without remark.

14/6 *Implantation of right ureter into colon according to CORREY II.* Subsequent course free from complications.

25/6 Non protein nitrogen 96 mgr % 28/6 52 mgr %

28/8 General condition good, patient has increased in weight, looks well, only slight secretion of urine from fistula.

2/9 *Extirpation of the remaining bladder-bottom together with a piece of the intestine + invagination of the end of intestine.*

Pat. went home 29/9, general condition then good, during the last month he had increased 4 kg, was dry and completely healed.

Subsequent course, on the whole, pat. has been perfectly well, has passed the Commercial High School in Helsingfors and, since then, has had a place for about 3 years in Imatra, he now thinks of marrying.

In Case no 3, complications ensued and, when the patient was discharged, the final result was not altogether satisfactory. The other three cases passed without complications. Case no 2 is of interest, a little girl born with ectopia vesicae and with the exterior genitalia absent could get a normal vagina dissected out and opened outwards. Case 4 is, to a certain degree, calculated to illustrate the superiority of the CORREY method as compared with older procedures, MAYDL's especially. When younger the patient had been operated according to a modified MAYDL. The operation had not succeeded in making him dry but, on admission here, he had a greatly secerning urinary fistula above symphysis, in addition to which the left kidney was transformed into a pyonephritic calcareous kidney with a large coral-stone.

## II Cancer vesicae urinariae seu papilloma (with malign tendency)

9 cases (5—13), 2 deaths (7 and 8)

*Case 5* Married woman, 57 years old Diagnosis *Cancer vesicae urinariae*

History of Case sickness began December 1940 with severe cystitic symptoms, tenesmus once an hour, day and night, and hematuria, the symptoms continued with intervals of slight moderation until she was admitted  $\frac{1}{3}$  1941 to the Medical Department of the Seraphimer Hospital, where tumour of the bladder was discovered and she was transferred to the Surgical Clinic  $\frac{8}{3}$  Urogram showed normal kidneys, coli-infected urine

$\frac{8}{3}$  Cystoscopy voluminous tumour-masses in bladder which has a capacity of only 100 cc Pat discharged  $\frac{13}{3}$  for roentgen treatment of bladder Pat readmitted  $\frac{23}{4}$  after having received 12 roentgen-treatments She had been better for a time, but was now again very severely distressed by frequent tenesmus, which returned at intervals of only 3—5 minutes Non protein nitrogen 32 mgr %

$\frac{7}{5}$  *Bilateral ureter-implantation according to COFFEY II* In the urinary bladder there was palpated a firm knotty tumour as big as a fist, firmly attached to its surroundings, non-extirpable The ureters distended to the thickness of a lead-pencil but with thin walls Subsequent course without remark Discharged  $\frac{19}{5}$

Subsequent examination freed by operation from the dreadful tenesmus attacks, but feels very tired, however In general, 5—6 evacuations of rectum every 24 hours Died following year

*Case 6* Workman at a confectioner's, 58 years old Diagnosis *Cancer vesicae urinariae*

History of Case since the beginning of 1941 had a difficulty in beginning to urinate, and the ray weaker and weaker, with droppings afterwards On one occasion,  $\frac{1}{1}$  1942, observed a slight mixture of blood in the urine Attended at the Surgical Clinic of the Seraphimer Hospital  $\frac{3}{1}$ — $\frac{21}{1}$  1942 General condition without remark, smarting on miction Urogram normal picture of kidneys, ureters and bladder, no impression in bladder-shadow Urine not infected On  $\frac{9}{1}$  cystoscopy normal capacity of bladder, redness of mucous membrane of bottom of bladder In other respects 0

On  $\frac{14}{1}$  and  $\frac{19}{1}$  fresh cystoscopies Nothing new observed

$\frac{20}{1}$  Cystography no pathological alterations observed in bladder The ureter, on  $\frac{21}{1}$ , free from symptoms

Pat readmitted  $\frac{13}{2}$  1943 in consequence of increasing severe cystitic symptoms, with increased hematuria  $\frac{15}{2}$  urogram normal picture left side, no secretion right side, bladder-contour to the right irregular and ragged  $\frac{17}{2}$  cystoscopy to the right, in the bladder, large coagula which, it is assumed, may conceal a tumour Non protein nitrogen

32 mgr % On  $19/2$  operation Explorative epicystotomy to the right in bottom of bladder a broad tumour, almost as large as a hen's egg and issuing from the bladder-wall, and adherent through to prostata, too, P A D *Sample-excision shows exfoliated epithelial cancer with horn-formation non-extirpable* Roentgen treatment begun, discharged  $11/3$

Readmitted  $5/4$  1943 in consequence of ever-increasing, almost unbearable pains on urination, mostly in the form of smarting and aching in penis and very frequent tenesmus, during last 3 weeks, unable to sleep in consequence of the above-mentioned pains

$3/5$  *Implantation of left ureter into colon in accordance with Coffey II* Right ureter, which was dilated to the width of a finger, divided and ligated in both directions Abscess in abdominal wall, otherwise no complications in subsequent course

Discharged  $4/6$  1943 is considerably improved, thanks to the absence of the frequent and painful tenesmus and pain in penis, pat's condition is now bearable, but he is still troubled by frequent defecation-urgency, about once an hour every 24 hours Died following year

Case 7 Watchman, 67 years old Diagnosis *Papillomata vesicae urinariae maligna*

History of Case since close of 1925, occasional hematuria, he was admitted  $6/4$  1936 to Surgical Clinic of the Seraphimer Hospital where he was afterwards attended on various occasions, the last being  $22/9$ — $29/10$  1937

$21/9$  1936 extirpation, after sectio alta, of two pendulous papillomata about half the size of a hen's egg, histologically benign

$1/12$  1936 electrocoagulation (by means of cystoscopy) of slight relapse (SHUBERTH)

$10/12$  1936 electrocoag of further relapse not formerly observed

$13/1$  1937 electrocoag of two additional relapses

$29/4$  1937 electrocoag of several small additional tumours

$27/9$  1937 with cystoscopy, there had been observed a large number of new tumours, and on  $27/9$  there was carried out explorative epicystotomy, when it was discovered that the tumours were extended over large areas of the bladder and, in many places, infiltrated down deeply Extirpation of the bladder after implantation of the ureters according to Coffey was found indicated

$18/10$  1937 *implantation of the left ureter into colon pelvin according to Coffey II* In consequence of extensive adherences around colon it was difficult to determine positions, and, by mistake, there was opened first of all a part of the colon lying rather high As, from this opening the tamponade introduced into rectum could not be reached, a new opening had to be made In other respects the operation was carried out typically

$25/10$  1937 an insidious peritonitis arose and the patient died  $27/10$  No autopsy performed

P A D of bladder showed *papillomata vesicae maligna*

*Case 8* Shoemaker, 72 years old Diagnosis *Papillomatosis diffusa vesicae urinae*

History of Case since close of February 1939 severe hematuria with troublesome tenesmus and with smarting in the urine duct on miction Since March 1939, and every now and then, pain in neighbourhood of right kidney, has grown thin Admitted to Surgical Clinic of Seraphimer Hospital  $20/8-2/9$  and  $6/9-21/9$  1939 Urine not infected Non protein nitrogen 33 mgr %

$1/9$  Cystoscopy bottom of bladder over a great area punctuated by papillomata, large and small, a number with broad bases and all lying close to each other Extirpation of bladder after implantation of ureter according to COFFEY was considered indicated

$15/9$  Implantation of both ureters into colon according to COFFEY II was carried out typically and without other complications than that cramp in the ureters made it necessary to introduce fewer ureter-catheters than had been intended The patient never recovered after the operation, but died with pulmonary symptoms on  $29/9$

Autopsy bilateral broncho-pneumonia + right-sided pyelitis Operation area without remark The right ureter displayed an S-shaped knee, right renal pelvis not expanded Left ureter ran direct down to place of implantation, left kidney without remark Both ureters well fastened into the intestine, and without infection

Mucous membrane of bladder thickly covered with papilloma no infiltration outside of mucous membrane

*Case 9* Merchant, 53 years old Diagnosis *Cancer vesicae urinae*

History of Case in 1904 nephrectomia dx on account of renal tuberculosis Since November 1936 frequent urinary tenesmus, and turbid urine, afterwards blood-mingled Attended at the Surgical Clinic of Seraphimer Hospital  $1/5-30/7$  1937 and  $22/11-7/12$  1937

$7/5$  Cystoscopy broad-based tumescent tumour at bottom of bladder, about as large as a walnut, not papillomatous resembling cancer. Urine yellow, cocci, coli

$24/5$  Explorative epicystotomy at bottom of bladder an extensive tumour-formation covering the entire bottom of bladder and a great part of the remaining bladder The tumour appeared partly more papillomatous, and partly more infiltrating and, on palpation, more with the appearance of small nodules in the mucous membrane, but it gave the impression, however, of affecting only the mucous membrane, and not of infiltrating deeply

$18/6$  Implantation of left ureter into colon according to COFFEY I Operation relatively difficult in consequence of patient's considerable obesity Subsequent course without remark

$5/7$  Extirpation of bladder P A D I Benign papilloma II Papilloma with cancer III Cancer highly infiltrating, fairly non-differentiated cancer, here and there greatly resembling the exfoliated epithelial cancer type

$30/7$  Pat discharged in good condition, almost healed Evacuates intestine 2-3 times nightly and, during day, is continent 4-5 hours

together  $^{24}/_{11}$  scraping out of fistula in abdominal wound P A D. cancer, to Radium Home Died 1938

*Case 10* Former ballet-master, 71 years old Diagnosis *Cancer vesicae urinae*

History of Case hematuria since close of September 1938, during last year ever-increasing urinary tenesmus, has become somewhat thinner Attended at Surgical Clinic of Seraphimer Hospital  $^{8}/_{12}$  1938— $^{8}/_{4}$  1939 and  $^{28}/_{4}$  1942— $^{4}/_{10}$  1942

$^{14}/_{12}$  1938 Cystoscopy entire right side of bladder-bottom the seat of an extensive papillomatous tumour-formation Urine not infected Non protein nitrogen 34 mgr %

$^{1}/_{1}$  1939 Implantation of left ureter and one of the right ureters (right kidney a double one) into colon according to COFFEY II The narrowest of the right ureters ligated Course after the operation non-complicated

$^{17}/_{2}$  1939 Extirpation of urinary bladder and prostata On cutting open the preparation, there were discovered many tumours in the bottom of the bladder, the largest half as big as a walnut, broad-based and solid, the other tumours more papilloma-like, all appeared to appertain only to the mucous membrane

P A D *Exfoliated epithelial cancer, partly papillomatous*

On  $^{8}/_{4}$  the patient was discharged almost healed

For two years after discharge, or until about the middle of 1942, the patient felt well and enjoyed good health, needed to empty rectum once or twice nightly and as often by day, some nights he had not needed to rise, has been extremely satisfied with his condition

Since middle of 1942 became worse, more frequent need to evacuate intestine, sometimes with aching in the small of the back On  $^{12}/_{9}$  1942 he felt cold and sickly, had since kept his bed at home Admitted  $^{28}/_{9}$  to Seraphimer Hospital in a desolate condition, Non protein nitrogen 134 mgr %

$^{4}/_{10}$  Dead

Autopsy right ureter cicatrically indurated at mouth, with total stenosis Right kidney transformed into a hydronephrotic sac The left kidney twice as large as a normal one and larded with abscesses, acute pyelonephritis Left ureters entrance into intestine without remark

*Case 11* Married woman, 55 years of age Diagnosis *Cancer vesicae urinae*

History of Case operated  $^{7}/_{5}$  1935 for cancer mammae sin, hematuria 1936, at cystoscopy, there was discovered a *papillomatous tumour, as large as a walnut, around the left ureter-mouth* Pat admitted to the Red Cross Hospital, and the tumour was extirpated  $^{7}/_{4}$  1936 after epicystotomy

P A D *Benign papilloma* 1937 symptom of stenosis at left ureter mouth, with *pyonephrosis*  $^{2}/_{1}$  1937 *nephrectomia sin*

In 1937, there was discovered on control-cystoscopy, a large number of small, soft papillomas at the bottom of the bladder, which were

removed by electrocoagulation at the cystoscopy. During the months immediately following, fresh relapses occurred again and again, and were treated in the same manner. Later on a relapse in the very entrance of the urethra into the bladder which could not be cauterized endovesically. Roentgen treatment in this case showed that it was not able to prevent the development of the papilloma. Infection made its appearance, with increasing bladder distress, and pyelitic attacks gradually made their appearance, too, in the remaining kidney. The patient's condition gradually became such that, in 1941, it was considered that implantation of the right ureter into colon and extirpation after bladder ought to be carried out.

Status presens <sup>1</sup>/<sub>9</sub>, 1941 good general condition. Patient distressed by very frequent and painful tenesmus, on some nights every hour, or even more frequently. Heart and lungs without remark. Urine very turbid, evil smell. Sediment very numerous white blood corpuscles, bacteria, masses of coli and cocci. Non protein nitrogen 36 mgr %. Cystoscopy capacity of bladder hardly 100 cc. Mucous membrane of bladder everywhere covered by a close coating of small, low papillomata.

<sup>25</sup>/<sub>9</sub>, 1941 *implantation of right ureter into colon pelvium* the ureter fairly greatly thickened.

The subsequent course was, at first, without remark, after some days, however, there occurred, with ever increasing frequency, violent attacks of pyelitis, always in connection with great distress from the bladder. The patient herself said that she had the impression that these attacks commenced in the affected bladder, and — in spite of the attacks of pyelitis, which now appeared every day — was very anxious to have the organ removed.

<sup>19</sup>/<sub>12</sub> 1941 *extirpation of urinary bladder*. The bladder shrivelled and greatly thickened, the mucous membrane of the bladder, in its entirety, so closely coated with papillomata that it resembled a silky carpet. P. A. D. *Papillomata maligna vesicae urinariae (cancer)*.

After the extirpation of the bladder there began a decided improvement in the patient's condition, which, previously, had been rather low, the attacks of pyelitis diminished in frequency, but still made their appearance every now and then.

During the 2 years immediately after this last operation, the patient's general condition was however, not so good, and for long periods she was an inmate of the Sophia Home Hospital, attempts at staying at home always leading to a deterioration in health. Decided improvement, however, during last year, the attacks of pyelitis have become more and more rare, and non protein nitrogen, which, occasionally, had been up to 100, has gradually fallen to about 50 or sometimes even less. She is up parts of the day, in good humour, generally has a good appetite and enjoys life, in spite of everything. She evacuates the intestine 3—4 times a night, and about as frequently during the day. For the greater part of the last few years she has, however, been at the hospital.

Case 12 Chief clerk, 58 years old Diagnosis *Cancer vesicae urinae*

History of Case October 1941, there sometimes came some drops of blood from the uretra after miction In November 1941, the doctor consulted found a blood-pressure of 230 which was considered to occasion the hematuria In December 1941, violent pains in the chest, infarction of the heart was found, and the patient was treated 3 months for this at Sabbatsbergs Hospital On  $13/2$  1942 cystoscopy (Sabbatsberg) *a small polypus which was removed P A D Polyp-like mucous membranal protrusion without reliable certain papilloma-structure* Fresh cystoscopy on  $2/7$ , *polypus masses at inner urethra opening*

$9/7$ , *Explorative epicystomy + extirp of papilloma + cauterization* (WIJNBLADH) Growth fully and irregular spread in the whole of the bladder, partly as elevated parts with extremely red surface, partly as papilloma, some as large as a hazel-nut and many smaller ones P A D At one place, *a highly corneous exfoliated epithelial cancer*, at another, *bladder-papilloma with cancerous degeneration* Admitted to Surgical Clinic of Seraphimer Hospital  $7/8$ — $8/8$  for eventual CORREY with extirpation of the bladder He was then in good condition Urine not infected

Urogram normal conditions On  $7/8$  cystoscopy (SCHUBERTH) in the bladder there were seen at a couple of places, some small patchy red elevations, otherwise 0 CORREY was considered not indicated for the present, remitted to Dr WIJNBLADH Again admitted to Seraphimer Hospital  $17/10$ ,  $20/10$  and  $26/10$ , when electrocoagulation of a good number of papilloma was carried out

On  $1/3$  1943, he was again admitted to the Seraphimer Hospital, as the patient now wished to be operated according to CORREY with extirpation of the bladder, as he had been advised to do Urine not infected Urogram normal conditions

$8/3$  *Implantation of both ureters into colon according to CORREY II* The first days after the operation, the abdomen was greatly tensed, and the general condition was in some degree affected From  $17/3$  inclusive, rapid improvement  $29/3$  patient discharged General condition very good, evacuates intestine twice nightly, occasionally during the day Readmitted  $23/5$  for extirpation of bladder

$25/5$  Urogram bilateral secretion, commencing simultaneously and at the proper time Renal pelvis and calyces somewhat broader than before CORREY operation

$7/6$  *Extirpation of urinary bladder*, mucous membrane of urethra prostatica normal, prostata allowed to remain Discharged  $30/6$

P A D *Macroscopically, no tumour visible or palpable in the preparation The mucous membrane swollen and oedematous* P A D Only in one of the places investigated, were there encountered *cancer growths of low differentiation*, in a granulation tissue rich in vessels

Subsequent investigation  $30/12$  1943 Pat states that he feels perfectly well, never thinks of his having been ill, a fortnight's official journey in Norrland without distress

Case 13 Director's Assistant, 46 years old Diagnosis *Cancer vesicae urinae*

History of Case since beginning of 1939, patient has now and then noticed that, for a couple of days, the urine was bloody, in between whiles, quite clear, no pains or other symptoms In the autumn of 1941 increased bleedings Then admitted to the Medical Department of the Central County Hospital, where albumen and blood were found in the urine The diagnosis seems to have been nephritis, and the treatment lying-still and diet No roentgen examination or cystoscopy was made In June 1942 urography was carried out, and then alterations in the left renal pelvis were suspected, guinea-pig test for the negative On  $20/10$  the patient consulted a private doctor in Stockholm The urography then carried out showed a tumour in the bladder, after which the pat was remitted to the Surgical Clinic of the Seraphimer Hospital, where he was admitted  $2/10$  1942 His general condition was then excellent

Urine not infected Non protein nitrogen 27 mgr %

On  $12/10$  there were carried out 1) *cystoscopy* To the left at the bottom of the bladder, a rounded ramified tumour as large as a hen's egg

2) *Extirpation of bladder tumour after sectio alta* From the left bladder-wall close to the ureter orifice there started a pendulous tumour with a root almost as thick as a little finger, the tumour was almost as large as a hen's egg, cloven asunder, papillomatous The root soft, without sign of infiltration The root was cut out by diathermy The doctor from the Radium-Home who was consulted considered, after inspecting the tumour and its root that insertion of radium was not indicated P A D *The tumour is built up of papillomatous cell-masses Among the cells very numerous mitoses, pointing to a strong tendency to proliferation, there existed cell-proliferation in the root too The morphological pictures speak in favour of the existence here of a bladder-papilloma with an initial cancerous degeneration*

On  $9/3$  1943 a fresh cystoscopy no signs of relapse Since April 1943, blood again now and then in the urine Pat admitted again to the Seraphimer Hospital  $15/5$ — $15/7$  1943 Cystoscopy  $10/6$  in posterior bladder-wall near the left ureter, a papillomatous tumour, with fine villi, which was as large as a good-sized hazel-nut *In addition small nodules half as big as a grain of rice were found diffusely in the entire bladder-bottom and also up in fundus*

$8/5$  *Extirpation of papillomatous bladder-tumour + small nodule in the bladder-wall, after sectio alta* The papillomatous, ramified, soft tumour removed In addition, one of the nodules was excised for P A D P A D *Cancer, both in the papillomatous tumour and in the nodule* Roentgen treatment begun Pat discharged  $15/7$

Pat readmitted  $3/5$ — $9/5$  1943 After being discharged on  $15/7$  was completely symptom-free, no urinary distress, good appetite, increased weight The roentgen-treatment series was finished in July

$3/9$  Cystoscopy no certain tumour-formation visible, the small nodules from the previous investigation gone



Pat readmitted  $2/_{12}$ — $9/_{12}$  Subjectively, perfectly well, urine macroscopically *hematuria*  $8/_{12}$  cystoscopy to the right on the bottom of the bladder, a conglomeration of broad-based small papilloma of the size of a penny in area, in addition a large number of small nodules in the mucous membrane, the wall on that area of the bladder indrawn, pointing to the tumour's having gone deeper into the wall and not having merely attacked the mucous membrane. The patient was advised ureter-implantation into rectum with extirpation of the urinary bladder, but he wanted to go home for Christmas first. But he returned again as early as  $12/_{12}$

$13/_{12}$  Urography kidneys of normal size and with normal secretion

$17/_{12}$  *Implantation of left ureter into colon pelv according to COFFEY II* A very great amount of intraperitoneal fat rendered the operation difficult. On palpation of the bladder there was found no tumour infiltration, this pointing to the tumours only affecting the mucous membrane. During the operation there occurred an interruption of spontaneous breathing for about 10 minutes, probably in consequence of a too hasty injection of narcotal. Partly on account of this, and partly on account of the technical difficulties, it was determined to put off the implantation of the right ureter to another séance. Subsequent course without remark.

$27/_{12}$  1944 *Implantation of right ureter into colon pelv according to COFFEY II* The operation was carried out without complications, and the subsequent course was without remark.

$3/_{1}$  *Extirpation of the urinary bladder and also of vesiculae seminales and prostata* The operation was somewhat troublesome in consequence of intensive adherences between the bladder and its surroundings, this, probably, partly depending on the previous intense roentgen treatment. Subsequent course without remark.

P A D *The bladder shows a hypertrophic muscular wall, and a highly fibrous, thickened submucosa with round-cell infiltrate.* The epithelium mostly gone and replaced by granulations. In spite of the imbedding of a large number of bits, only in one place has there been found a cancer-growth, little larger than the head of a pin, and lying like a little polypous nodule in the mucous membrane. The cancer has papillary structure, and such an epithelial picture as that characterizing *bladder-cancer*. Subsequent course without remark.

$17/_{5}$  Pat discharged in good condition, has lately taken long walks. Fairly slight distress from intestine, needs to evacuate intestine once or twice nightly and 2—3 times by day. The wound shallow, in process of good healing and about as large as a florin.

In the two cases of inoperable cancer of the bladder, (5 and 6) there was obtained by the operation the intended aim to prevent the very severe cystic distresses, above all the very frequent and painful attacks of tenesmus. Of the 7 treated cases of extirpable bladder-tumours, 2 died, both of them men, one in insidious peritonitis and the other in bronchopneumoniae. In the last-mentioned case, the implantation-places of the ureters into the intestine were without remark, in the first case, no

autopsy was carried out. In the remaining 5 cases, the planned operation was carried out with, consequently, to begin with, ureter-implantation and, later on, total extirpation of the urinary bladder. Of these cases, one died less than 1 year after the removal of the bladder, of a cancer-relapse, another died of acute pyelonephritis about  $3\frac{1}{2}$  years after the last operation. He had been quite well for 3 years, during the last half year afterwards, he had been troubled by very frequent evacuations of the intestine with aching in the loins. The autopsy showed the absence of cancer. The remaining 3 cases are still alive. One of them a woman, 53 years old, is still ( $3\frac{1}{2}$  years) after the extirpation of the bladder without symptoms of cancer-relapse. At first, after the last operation, she was distressed by fairly close attacks of pyelitis which, however, during the last year, became less and less frequent. Her general condition is, on the whole, good, but non protein nitrogen is heightened, usually lying somewhat above 50 mgr %. The 2 remaining cases, both of them men, were operated, one about a year ago and the second this year (1944), their condition is very good, and both are fully capable of work.

### III Tuberculosis urogenitalis with fistulae.

2 cases (14 and 15), 1 death

*Case 14* Technologist, 26 years of age

History of Case in 1928 urination distress, tuberculosis in left kidney was diagnosed, and the left kidney was removed. Pat afterwards attended at various periods during the years 1931—1937 at the Surgical Clinic of the Seraphimer Hospital, under the diagnosis *Tuberculosis renis dx + cystitis tuberculosa*. In 1931 there was made a supra-pubic bladder-fistula in consequence of acute hematuria with distension of the bladder, and coagula. After the fistula had healed in a couple of months, the pat was discharged and afterwards, on the whole, was well until the summer of 1936 when very frequent tenesmus with incontinence appeared. From  $\frac{16}{5}$  to  $\frac{30}{10}$ , both days inclusively 1937, he was cared for at the Seraphimer Hospital, during as good as all that time he lay with catheter *à demeure*, but this troubled him a great deal, however. Gradually a fistula made its appearance at the root of penis, and another fistula came in the abdominal scar, the urine emptied itself through both of these. The patient was in despair at his condition, after much doubt, in consequence of his rather bad condition — non protein nitrogen, which previously had been up to over 50 now, had fallen below this figure, however — it was decided to endeavour to mitigate his distress by a COFFEY operation.

$\frac{25}{10}$  1937 Ureter-implantation into colon according to COFFEY II. The ureter was greatly thickened up to the breadth of a little finger, it was sewn into the intestine typically — The first few days afterwards, there was a good stream of urine through the catheter, but anuria gradually appeared with *mois*,  $\frac{30}{10}$ , with signs of uremia.

Autopsy the right kidney displayed extensive, acute pyelonephritis and an extensive system of tuberculous caverns, in addition there was extensive tuberculosis in prostata, and vesiculae seminales with caseous cavities

*Case 15* Clerk, 19 years old Diagnosis *Cystitis tuberculosa + Stricture urethrae tuberculosa c fistula perinei et crenae ani*

History of Case operated at the Nyköping Hospital, for right-sided renal tuberculosis with nephrectomia dx, on  $13/10$  1937 There was then also discovered stricture in the urethra Afterwards well until 1940, when the pat was several times admitted to the same hospital for sounding of the stricture and, after this was done, for cauterization of the fistula which had arisen after this operation, and lay anteriorly at the scrotal root Once more admitted, this time at the beginning of 1941 for pains in perineum On  $21/3$  there was opened a pus-cavity, as large as a fist, and extending upwards along the left side of rectum, but also forwards to the left in perineum The scraping out of granulations from the cavity showed *tuberculosis* Both this cavity, together with an anterior one continuing towards urethra were revised and treated with iodoform-glycerine in September, and were thought to display a certain tendency to healing After it had been found, at the beginning of 1942, that rather much urine ran out in the fistula close to anus, there was arranged a cystic fistula On the  $2/7$ , 1942 the patient was admitted to the Surgical Clinic of the Seraphimer Hospital to undergo an operation according to COFFEY His condition was pretty good, but he was considerably distressed partly by the bladder-fistula and by the urine-leakage through the fistulae, especially on defecation, the patient also sometimes complains of as good as constant aching in the neighbourhood of the bladder, this latter distress being sometimes very troublesome and preventing him from working On admission to the hospital, the patient had his cystic fistula and, in addition, two fistular openings, one, a smaller, about 4 cm in front of anus and a larger one as wide as a little finger about 2 cm behind it His sickly condition makes the patient a complete invalid

$8/7$  Urethrography both the last-mentioned fistulae originated from urethra prostatica, the bladder was hardly larger than a walnut Discharged He was readmitted on  $2/9$ , 1942 Condition as before Non protein nitrogen 31 mgr %

$14/9$  A scraping out of the fistulae displayed tuberculous granulation (P A D)

$21/9$  Implantation of left ureter into colon according to COFFEY II Subsequent course without remark

Status on discharge,  $17/10$  general condition very good, evacuated the intestine once nightly and 4—5 times by day The skin around the anal opening which, previously, was macerated and smarted, is now as good as normal No distress from neighbourhood of bladder nor from the fistulae which are in process of healing

In one of these cases, a man 26 years of age, ureter-implantation was carried out for the purpose of alleviating or, preferably, free the patient from the extremely severe distress caused by his grave tuberculosis of the bladder and constant tenesmus and painful fistulae. It was considered that there was no hope of curing the patient as tuberculosis had been discovered in his remaining kidney. This was more serious, however, than it had been considered and uremia appeared in direct connection with the operation, with *mors* only 5 days afterwards. In the second case, also one of bladder-tuberculosis with fistulae, the general condition of the patient was fairly good, but the extremely severe urinary tenesmus and the painful fistulae made him an invalid. In this case, the result of the operation was extremely good, and for about a year, the patient has now been fully at work in an office.

#### IV *Fistulae vesico- et rectovaginal et region sacral.*

##### 1 Case (16) dead

*Case 16* Married woman, 50 years old. Diagnosis *Status post carcinoma colli uteri* (Roentgen- and radium treatment) + *fistula vesico- et rectovaginal* + *fistulae region sacral* + *peritonit postop*

History of Case in 1937 and 1938 treated at the Radium Home for cancer colli uteri by means of radium- and roentgen treatment. In 1938 also electrocoagulation deep within the right parametrium. In October 1938, urine through vagina, some weeks later, fecal evacuation the same way. In January 1939 a hole opened to the right of sacrum, and the urine and feces were evacuated through this new fistula. During the years 1939 and 1940, extremely great distress with severe pains on evacuation when the feces were pressed out through the fistulae.

On 3/7, 1941 there was carried out (at the Caroline Hospital) an *anus preternaturalis at flexura sigmoidea*, after which the patient experienced considerable relief. COFFEY was considered but, after deliberation, found not suitable here, after it was discovered that the right kidney, too, did not function.

On 27/4, 1942 the patient was admitted to the Surgical Clinic of the Seraphimer Hospital. Her general condition was fairly good, but she was in despair at her invalid condition which consisted in the running of the urine, without any possibility of control at the back, through vagina, from rectum and sometimes from urethra.

4/5, 1942 *implantation of left ureter into caecum according to COFFEY I*. The caecum, which lay far down and was very mobile (as had previously been discovered roentgenologically), was released still further and was drawn down over the median line to the left side, where it was made fast by a number of serosa sutures. The implantation of the left ureter which, macroscopically, was normal, was then carried out easily and typically according to COFFEY I, and without any tension. On palpation, the right kidney was found to have superficial depressions,

and to be smaller than normal. The condition of the patient after the operation was at first satisfactory, and on the  $\frac{8}{5}$ , that is, 4 days after the operation, evacuation of the urine and the feces in large amounts through the colostomy, general condition good.

$\frac{11}{5}$  Symptom of perforation-peritonitis, with *mors* after some hours.

Autopsy the proximal part of ureter well healed into the colon wall, distally, there had been formed an abscess which brought about communication from the intestine put into the abdominal cavity with consequent peritonitis. Right kidney hydronephrotic granular kidney without discerning parachym.

This patient, a married woman 50 years old, after radiological treatment of a uterus-cancer had gradually got necrosis in the bladder and rectum, with fistula-formations outwards, and had been reduced to such a position that she firmly declared that she considered she could not live any longer unless her condition could be improved. At another hospital the thought of an operation in order to eliminate the urinary fistulae had been discouraged by the doctor in charge of the case. The case, too, was a complicated one from an operative point of view. An implantation of the ureter into colon pelvinum, or into rectum, would be of no use, the rectum being partially necrotized away, and as the sphincter, too, was not sufficient. The remaining possibility was ureter-implantation into coecum, an operation which, if successful, ought to improve her situation considerably. Here, however, the difficulty presented itself, that the right kidney — whose ureter would, of course, have been the best for such an implantation — was destroyed, probably through an ascending pyelonephritis after ureter stenosis arising in connection, either with the uterus-cancer or from its treatment. However, after it had been found roentgenologically that coecum was very mobile, it was determined to try to carry out the operation as follows: the mobile coecum to be drawn over and made fast on the left side, and that afterwards, the left ureter should be implanted into it. The operation was carried out with unexpected ease, but afterwards infection appeared at the place of implantation, together with abscess and perforation-peritonitis, which brought *mors*. There is reason to assume that this complication had been brought about in consequence of the vitality of the intestinal wall having been reduced by the intense radiological treatment.

Finally, summarizing, I should like to make the following remarks, supported to some extent by our cases, few although they are. The dangers and inconveniences attendant on operations according to COFFREY are, above all 1) the risk of *infection with peritonitis at the place of implantation*, 2) the risk of a *later infection ascending to the kidney via the ureter, with a development of pyelonephritis*.

As is seen, too, by our material, the risk of peritonitis is slight but, however carefully the technic may be carried out, it can

hardly be entirely eliminated Whether operating extraperitoneally, or with operation according to HIGGINS can diminish the risk, appears doubtful Respecting the risk of pyelonephritis it may be remarked, firstly, that CORREY's hope that this risk can be entirely eliminated by the use of his special sewing-in technic, has *not* been realized Probably this is partially connected with the fact that, even if by means of the CORREY method, an ascension of gases and intestine-content into the lumen of the ureters, is eliminated to a certain degree, still, there is not prevented by this method the lymphogenous spread of infections along the ureter-wall It would seem, however, as if an ascending infection with pyelonephritis, after a CORREY operation — in whatever way it may arise — is far rarer in children, especially, than in adults This circumstance is important and is calculated to support the conception that in the treatment of ectopia vesicae in children, operation according to CORREY, in accordance with the rather great experience we have now gained, constitutes a very great advance in respect to all the older methods employed, and, consequently, should be the chief method of treatment of this severe disease

But also in the treatment of tuberculosis of the bladder, with fistular formations, of inoperable bladder-fistulae of other kinds and, above all, of tumours of the bladder, a CORREY operation can be of great value either — in the inoperable cases — as a palliative action to alleviate the distress, or, in the extupable cases, as a condition for obtaining a radical cure In our material, too, both the categories are represented It is true that the cases in our material where total extirpation of the bladder was found possible, are still few in number — 5 altogether — but, still, the result seems encouraging But, to be able to correctly deal with these important cases it is necessary, however *that* the cases must come at an early date for treatment, *that* a correct judgment must be formed of their operability and, *that* there must exist experience for the correct drawing of a prognosis, based on an ever increased and more intimate knowledge of the macro- and microscopic pictures of these tumours, together with their clinical aspects In this respect, the fundamental investigations carried out by means of the Stockholm Radium Home's material of cancerous tumours — uterus-cancers especially — in the female genital organs ought to serve as a pattern.

### Summary.

The author communicates 16 cases of ureter implantation into colon pelvinum according to COFFEY. The diseases on account of which the operation was carried out were the following: *Ectopia vesicae urinariae* (4 cases), *cancer vesicae urinariae* (9 cases), *tuberculosis urogenitalis* (with fistula) (2 cases), *roentgen-treated cancer uteri* (1 case). Four of the cases died in direct connection with the operation, namely 2 cases of cancer of the bladder, 1 of urogenital tuberculosis, and the case with fistula after the roentgen-treated uterus-cancer. Of the 4 ectopia cases, 3 are living in good health, 8, 6 and 4 years after discharge. One case has not been found. Of the discharged 7 cases of cancer of the bladder, there was carried out, at a later séance, in 5 cases, total extirpation of the bladder, of these 1 died after a year of cancer relapse, 1 after 3½ years of pyelonephritis (no cancer relapse found on autopsy). Of the remaining 3 cases of extirpation of the bladder 1 lives free from symptoms after 3½ years, 1 lives also free from symptoms after 1 year, and 1 has been lately operated. In the 2 remaining cases of the 7 with cancer of the bladder, the cancer was inoperable and operation according to COFFEY was carried out merely to relieve the patient of the severe bladder distress. These cases died within a year after discharge. Of the cases with urogenital tuberculosis, one lives, 2 years afterwards in good health and fully capable of work.

### Zusammenfassung

Verf. teilt 16 Fälle von Ureterenimplantation in das Colon pelvinum nach COFFEY mit. Die Krankheitszustände, bei denen der Eingriff vorgenommen wurde, waren folgende:

*Ectopia vesicae* (4 Fälle), *Cancer vesicae urinariae* (9 Fälle), *Tuberculosis urogenitalis* (mit Harnfistel) (2 Fälle), *strahlenbehandeltes Uteruskarzinom* (mit Harnfisteln) (1 Fall). Vier der Kranken starben im direkten Anschluss an den Eingriff, und zwar 2 Fälle von Blasenkarzinom, 1 Fall von Urogenitaltuberkulose sowie der Erstfall nach dem strahlenbehandelten Uteruskarzinom. Von den 4 Ektopie-Fällen leben 3 gesund, 8 bzw. 6 und 4 Jahre nach dem Eingriff, einer konnte nicht wiedergefunden werden. An 5 von den entlassenen 7 Fällen von Blasenkarzinom wurde später Total

exstirpation der Blase vorgenommen Von diesen starb einer ein Jahr nach der Entlassung an Krebsrezidiv, einer  $3\frac{1}{2}$  Jahre später an Pyelonephritis (bei der Sektion kein Karzinom nachweisbar) Von den 3 übrigen lebt einer symptomfrei  $3\frac{1}{2}$  Jahre nach der Operation, einer gleichfalls symptomfrei 1 Jahr nach der Entlassung, und einer ist erst kurzlich operiert Von den Fällen mit Urogenitaltuberkulose lebt einer gesund und völlig arbeitsfähig 1 Jahr nach dem Eingriff

### Resumé.

L'auteur communique 16 cas d'implantation des uretères dans le colon pelvien d'après COFFEY Les affections pour lesquelles l'intervention eut lieu étaient les suivantes

*Exstrophie vésicale* (4 cas), *cancer de la vessie* (9 cas), *tuberculose urogénitale* (avec fistule urinaire) (2 cas), *cancer utérin malade* (avec des fistules urinaires), (1 cas) Quatre des cas succombèrent directement à la suite de l'intervention, soit 2 cas de cancer vésical, 1 cas de tuberculose urogénitale, et enfin le cas avec les fistules consécutives à l'irradiation d'un cancer de l'utérus Trois des cas d'exstrophie sont vivants et en bonne santé 8, 6 et 4 ans après l'intervention, le quatrième n'a pu être rejoint Chez 5 des 7 malades atteints de cancer de la vessie qui quittèrent l'hôpital on pratiqua plus tard l'exstirpation totale de la vessie, l'un d'eux mourut un an après l'exeat, de récurrence de sa tumeur, un autre au bout de  $3\frac{1}{2}$  ans, de pyélonéphrite, à l'autopsie on ne put trouver aucune trace de cancer Des trois derniers, l'un vit et ne présente point de symptômes pathologiques  $3\frac{1}{2}$  ans après l'opération, le second de même est indemne de symptômes malades un an après l'exeat, et le troisième a été opéré récemment

L'un des cas de tuberculose urogénitale vit en bonne santé et jouit de toute sa capacité de travail un an après l'intervention

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From the Neurosurgical Clinic, Serafimerlasarettet,  
Stockholm, Sweden

## Ligature of the Carotid Artery in Intracranial Aneurysms.

By

H OLIVECRONA

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It has long been known and was pointed out again by HULTQUIST (1) in a recent monograph, that thrombosis of the common or internal carotid artery rarely leads to cerebral softening. Unless the thrombotic process reaches the neighbourhood of the first branches of the internal carotid artery, the ophthalmic and the anterior cerebral artery or emboli are given off from the thrombus, there seems to be very little risk of disturbance of the cerebral circulation.

On the other hand ligature of the carotid artery is frequently followed by cerebral complications and even death. WATSON and SILVERSTONE (2) for instance had a mortality of 55 % in 20 cases of ligature of the common carotid artery performed in cases of malignant tumors of the mouth and face, nearly all fatalities being due to cerebral softening. On the other hand SCHORSTEIN (3) found that in 22 ligations of the internal carotid artery for infrachnoidal aneurysm, only three cases showed signs of impaired cerebral circulation, and in all these cases the aneurysm was complicated by hemorrhage. In WATSON's and SILVERSTONE's fatal cases the indication for carotid ligation was hemorrhage, either from an ulcerating tumor or from accidental lesions of important vessels during removal of metastatic tumors in the neck.

JEFFERSON (4) was the first to point out the important fact that the bad reputation of carotid ligation is due mainly to conclusions drawn from statistics based on cases of the type reported by WATSON and SILVERSTONE where the general and cere-

bral circulation are impaired before operation because of hemorrhage, infection and so forth and that these statistics cannot be used as a basis for evaluation of the risks of carotid ligation in cases where these factors are absent. New statistics on the subject are urgently needed and have recently been published by SCHORSTEIN (3) based largely on material from JEFFERSON's clinic. SCHORSTEIN collected 33 cases adding 27 cases from the literature where the carotid artery had been ligated in cases of saccular intracranial aneurysms. His analysis of these cases brought out a number of interesting facts, the most important being, that the outcome of the ligation is mainly dependent on the condition of the cerebral circulation before operation. If the cerebral circulation was impaired before operation, either because of a local disturbance or because the general circulation was deficient, carotid ligation carried considerable risk, otherwise not. In infrachnoidal aneurysms where the cerebral blood vessels as a rule do not suffer compression from the aneurysmal sac, ligation of the internal carotid was uniformly successful, unless hemorrhage affecting the general condition of the circulation had occurred. In suprachnoidal aneurysms where local compression of one or more arteries of importance for the collateral circulation commonly occurs the ligation carried considerable risk. SCHORSTEIN also confirmed JEFFERSON's observation that recent leakage because of the attending rise in intracranial pressure is a factor gravely compromising the outcome of carotid ligation. In 9 cases of this kind there were 5 fatalities and 3 of the 4 survivors showed signs of transient neural damage. KRAYENBUHL (5) was more lucky with his cases of suprachnoidal aneurysms complicated with leakage. Two cases of this kind were successfully ligated, but these two successes must be regarded as an exception rather than the rule and are hardly sufficient to invalidate the conclusion of SCHORSTEIN that in the presence of recent leakage carotid ligation is a very dangerous procedure.

Aside from preoperative impairment of the cerebral circulation there are probably other factors, which influence the outcome of carotid ligation. There has been some discussion concerning the possible influence of vasoconstrictor impulses initiated at the site of ligation and causing a reduction of the volume of blood flowing through the remaining arteries of the brain. HULTQUIST (1) is inclined to regard a mechanism of this kind as chiefly responsible for the relative frequency of cerebral complications fol-

lowing carotid ligature as compared with spontaneous thrombosis of the carotid artery. Others have expressed similar views. HULTQUIST does not take into account however, the preoperative state of the cerebral circulation. As a matter of fact there seems to be very little if any difference in the frequency of cerebral complications in carotid thrombosis and carotid ligature provided cases complicated by hemorrhage, leakage or a local or general rise in the intracranial pressure are excluded. The principal argument advanced to support the theory of vasoconstrictor impulses therefore is fallacious and there remains very little positive evidence to support it. It is also probable as pointed out by SCHORSTEIN (3) that the possible vasoconstrictor effect of carotid ligation is likely to be overruled by the vasodilator action of the increase in carbon dioxide tension which occurs as a result of the reduced blood flow.

In a number of cases we tried to eliminate vasoconstrictor reflexes by doing a periarterial sympathectomy before ligating the carotid artery. No definite conclusions can be drawn from these experiments but it is evident that a periarterial sympathectomy is no safeguard against cerebral complications as shown by case no. 2, and also other cases where signs of cerebral ischaemia occurred in spite of sympathectomy.

For many years the theory of PERTHES (6) that thrombosis at the site of ligature and secondary embolism was responsible for the cerebral anoxaemia, which sometimes follows ligature of the internal carotid artery, has been rather generally accepted. It was pointed out by SCHORSTEIN (3) however that ligation of the internal carotid artery is much more dangerous than ligation of the common carotid artery. If thrombosis and embolism were to any considerable extent responsible for the cerebral complications following ligation one should expect signs of disturbance of the cerebral circulation to occur with approximately the same frequency after ligation of the common as after ligation of the internal carotid artery. Moreover at autopsy thrombosis has rarely been found in cases which ended fatally, and embolism is of course actually disproved in cases where the cerebral circulation is restored after release of the ligature.

In this clinic ligature of the common or the internal carotid artery has been carried out in 25 cases. In two of these the common carotid was ligated, in all the others the internal or both the internal and the common carotid artery were tied off, usually

with coarse linen thread, in two cases with a strip of fascia. The indications for the ligature are seen in Table I.

Table I.

*Infraclinoidal aneurysms*

## A Saccular

Three cases

## B Arteriovenous (in the cavernous sinus)

Six cases

*Supraclinoidal aneurysms*

## A Saccular

Nine cases

## B Arteriovenous aneurysms

Seven cases (Verified by arteriography)

None of these cases were complicated by recent leakage or pre-operative hemorrhage. A moderate increase of the intracranial pressure was present in one case of supraclinoidal arteriovenous aneurysm, who had a choked disc, and in one case having a very large saccular aneurysm arising from the anterior cerebral artery. In both these cases ligature of the common carotid artery was carried out and was well tolerated. In the remaining cases there were no symptoms indicating a local or general disturbance of the cerebral circulation. In all these cases except one, where the common carotid was ligated and which will be described in detail later, the ligature was applied to the internal carotid artery.

In the *saccular infraclinoidal aneurysms* the ligature was well tolerated in all three cases belonging to this group. In the *arteriovenous infraclinoidal aneurysms* ligature of the internal carotid artery was well tolerated in four cases, in the two remaining cases the ligature had to be removed (cases no 1, 2).

Case no 1. Neurosurgical clinic 650/37. M. B. ♂ 50 years. On July 10th, 1937, the patient was hit in the region of right eye by a small piece of flying steel thrown up by a passing motor car. He was able to remove a small piece of steel from a superficial wound near the right eyebrow but then fell to the ground and was unconscious for a few minutes. On regaining consciousness the following symptoms were present: 1) a roaring noise in the head, localized to the temples and synchronous with the pulse, 2) a right-sided pulsating exophthalmus of moderate degree, 3) a moderate impairment of vision in the right eye, 4) double vision which disappeared after a few weeks, 5) a right-sided hemiparesis, which had largely disappeared some months

later, 6) a left-sided hemihypaesthesia to pain and temperature from the fourth thoracic segment downwards

The patient passed through various hospitals and was finally admitted to the neurosurgical clinic on Nov 11th, 1937. After injection of thorotrast into the right carotid artery the films showed a diffuse shadow in the region of the cavernous sinus. The opthalmic, angular, anterior facial and pterygoid plexus veins were much enlarged. Our impression was that a tiny piece of steel had passed through the superior orbital fissure, the right cavernous sinus and carotid artery and finally became lodged in the brain stem partly severing the spinothalamic tract on the right and damaging the pyramidal tract on the left side.

Immediately after the arteriograms had been completed a ligature was applied to the right internal carotid artery. The artery had first been compressed for 10 minutes without any symptoms. The bruit disappeared immediately and there were no signs of disturbance of the cerebral circulation for the first two or three hours. Three and a half hours after ligation of the carotid artery the patient had an epileptic fit, became drowsy and within two hours unconscious. A complete left-sided hemiplegia had developed. Six hours after operation the wound was reopened and the ligature removed. The patient regained consciousness within the next few hours and the following morning the left-sided hemiplegia had completely disappeared. The bruit was again audible and the exophthalmus reappeared. He was discharged a week later in the same condition as before operation. His last report in Febr 1942 states that his condition is essentially unchanged although the bruit has decreased in intensity.

Case no 2 Neurosurgical clinic 483/42. A. A. ♂ 17 years. On May 13th, 1942, the patient was hurt by falling on a hay fork which penetrated into his right nostril. He was brought to a hospital where a hematoma in the eye lids on the right side was noted, but otherwise no signs of serious injury found. A few days later the patient noted a noise in his head synchronous with the pulse and a pain behind his left eye recurring with each beat of the pulse. Two weeks later double vision appeared and by the end of June a pulsating exophthalmus on the left side was present. He was admitted to the neurosurgical clinic on July 17th, 1942. The following symptoms were present. A pulsating exophthalmus of moderate degree (protrusion 4 mm as compared with the right side), slight haziness of the disc margins on the left side with normal vision, veins wide and tortuous. A very loud bruit could be heard over the entire head. The left corneal reflex was slightly decreased. Arteriograms showed a very large aneurysm in the region of the left cavernous sinus, the carotid artery above the aneurysm was not visible at all. The left internal carotid artery was ligated after a periarterial sympatectomy had been done.

Four hours later the patient suddenly became aphasic and had a slight feeling of numbness in his right hand. His aphasia rapidly became profound but mainly motor in type. Four and a half hours after operation the wound was reopened and the ligature removed. The

aphasia disappeared almost immediately. The following day there was a slight relapse of the feeling of numbness in the right hand and also some difficulty of speech but these symptoms cleared up spontaneously after a few hours.

Two days after the first operation the wound was again reopened and a ligature applied to the common carotid artery. This was well tolerated, the exophthalmus decreased slightly and the bruit almost disappeared. The patient was discharged a week later.

His exophthalmus did not disappear and a bruit persisted the following two years. He was therefore encouraged to return and was again admitted to the neurosurgical clinic on May 24th, 1944. There was still a slight degree of pulsating exophthalmus, and a fairly loud bruit could be heard over the left temple and orbit. Vision was normal, the corneal reflex still slightly diminished. On June 1st, 1944, the left internal carotid artery was ligated. No symptoms followed. The pulsations of the bulb disappeared but the bruit could still be heard though less distinctly. On June 13, 1944, a flap was turned down in the left frontal region and a silver clip applied to the left carotid artery at its point of emergence from the cavernous sinus. It was noted during the operation that the bone and dura were rather vascular.

There was no further decrease of his exophthalmus and a faint bruit could still be heard over the left temple. Obviously an arterial communication to the aneurysm probably via the ophthalmic artery, still exists. Similar experiences have been recorded by DANDY (7).

In the nine cases of *supraclinoidal saccular aneurysms*, the common carotid artery was ligated in one case, the internal carotid in the remaining cases. In two of the latter cases signs of transient neural damage occurred. In one of these cases, a boy 17 years of age who had a beansized aneurysm on the left anterior cerebral artery, aphasia and a right-sided hemiplegia began to develop rapidly 43 hours after the left internal carotid artery had been ligated. It was already decided to remove the ligature when his condition began to improve and re-operation was therefore post-poned. His condition continued to improve and he was discharged a week later completely well. In the second case, a woman 40 years of age with a large supraclinoidal aneurysm, the point of origin of which could not be accurately determined, ligation of the left internal carotid artery was followed by a sharp exacerbation of trigeminal pain, which had been present for some time before operation. The pain gradually became so severe that a tractotomy had to be done a week after the first operation. A week later a right-sided facial palsy and slight aphasic disturbances slowly developed but gradually disappeared within the next three weeks. At her last examination in July 1944,

two years later, this woman was completely well and even the visual field defects had disappeared. In this case it seems probable that ligation of the carotid artery was followed by thrombosis and swelling of the aneurysm resulting first in increased pressure on the trigeminal root, and later also on the middle cerebral artery.

In the remaining seven cases belonging to this group ligation of the carotid artery was tolerated without the slightest sign of neural damage.

In the last group, the *supraclinoidal arteriovenous aneurysms* the results of carotid ligation were disastrous. In four of the seven cases belonging to this group, hemiplegia, which in two cases became permanent, resulted. These cases are briefly reported below.

Case no 3 Neurosurgical clinic 315/40 G B ♂ 40 years Arteriovenous aneurysm of the left parietal region, main feeding artery, middle cerebral. Chief symptoms, epileptic fits since 10 years. Arteriography, ligation of the left internal carotid artery. Twelve hours later right-sided hemiparesis and aphasia developed. Immediate removal of ligation was followed by improvement but a few hours later hemiparesis and aphasia again became more pronounced. It was noted that the bruit, which had been present before ligation and which disappeared when the carotid artery was tied, was absent in spite of release of the ligation. His condition gradually improved but at the time of discharge a slight hemiparesis and a moderate degree of aphasia were still present. A year and a half later slight aphasic disturbances were still present and the epileptic fits also continued. The patient ended his life by suicide 2½ years after operation.

The absence of the previously observed systolic murmur in spite of release of the ligation as well as the increase of symptoms some hours after removal of the ligation indicates that thrombosis of the aneurysm occurred.

Case no 4 Neurosurgical clinic 431/40 E P ♂ 20 years Right frontal and parietal arteriovenous aneurysm. Main feeding artery, middle cerebral. Symptom epileptic fits since one year. After arteriography, ligation of the right internal carotid artery. Two days after operation the patient had twitchings of the left leg and thought that his left arm was weaker. Objectively no paresis could be detected. On the third day there was definite weakness of the left arm. During the course of the fourth day the entire left side of the body gradually became paralyzed.

It was thought at the time that the symptoms were due to a thrombosis of the aneurysm and no attempt to restore the cerebral circulation by removing the ligation was made. Unfortu-



nately there is no note of the presence or absence of a bruit either before or after the operation, and the diagnosis of thrombosis therefore does not appear well founded. No doubt the ligature should have been released already on the second day when the first signs of impaired cerebral circulation appeared, or else the aneurysm should have been removed immediately. It had been planned in this case to remove the aneurysm and the carotid ligature was meant to be a preliminary step in order to facilitate the subsequent removal of the malformation. Owing to my absence from the clinic this stage in the treatment had been postponed.

Case no 5 Neurosurgical clinic 774/39 S J ♂ 37 years. The present illness began in July 1937 with three epileptic fits, probably initiated by turning the head to the right. He was admitted to the neurological clinic at Serafimerlasarettet where arteriograms were made, showing a large arteriovenous aneurysm in the left precentral region. Two large feeding arteries came from the middle cerebral artery. The lesion was considered inoperable and roentgen treatment was given and repeated later the same year. During the following 1½ years he was comparatively well and able to work but in May 1939 he became psychotic and was admitted to an insane asylum where he spent the following four months. His psychosis was an atypical confusion syndrome with outbursts of violence. He gradually recovered and became rational but remained dull and emotionally unstable. He was admitted to the neurosurgical clinic on Nov 11th, 1939. Aside from the above mentioned mental symptoms his neurological condition showed nothing abnormal except for a questionable swelling of the optic discs.

It was decided to repeat the arteriograms in order to obtain more accurate information of the position and origin of the feeding arteries, and if these were found to be accessible to remove the lesion. The left carotid artery was re-exposed in local anaesthesia but repeated attempts to inject first the internal and then the common carotid artery resulted only in filling of the branches of the external carotid artery. The films (Fig 1) showed that the internal carotid artery was completely obliterated at the level of the anterior clinoid process. Since there was some bleeding from the punctured carotid artery the artery was ligated.

On the morning following operation it was noted that the patient had difficulty of speech, which progressed rapidly so that 24 hours after operation he was completely aphasic and almost completely hemiplegic. The ligature was removed about 25 hours after its application and pulsation in the internal carotid artery above the site of ligation immediately returned. There was no improvement of motor or speech functions. At his discharge two months later some motor power had returned in the leg but not in the arm and his aphasia remained massive.



Arteriogram in case no 5 Shadow of thorotrast terminates abruptly at the level of the anterior clinoid process

OLIVECRONA Ligature of the Caratid Artery



It was first thought that the obliteration of the carotid artery had developed in the interval between the first and second hospital admissions, and that the deficiency of the collateral circulation was due to vasoconstrictor reflexes released by the carotid ligature. This interpretation of the facts must be discarded for several reasons. In the first place it must be assumed that an oblitative process of unknown nature, presumably falling within the category of obliterating thrombangitis, had occurred in the carotid artery at a level just below the circle of Willis. This however appears to be a remote possibility even if it cannot be entirely excluded. In obliterating thrombangitis of the carotid artery episodes of transient monoplegias or hemiplegias usually occur before the cerebral circulation is so deficient, that hemiplegia becomes definite. The arteriograms in thrombangitis obliterans are typical and show a funnel shaped obliteration quite different from the one seen in case no 5 (Fig 1) where the shadow of the carotid artery terminates abruptly, reminding much more of an artery occluded by an embolus than by a slowly progressive constriction of the arterial wall.

The injection of thorotrast probably dislodged a thrombus already present in the carotid artery above the bifurcation or else clotting occurred within the syringe or needle introduced into the carotid artery. This latter event appears more probable since a clot easily occurs if blood is allowed to run into the syringe and mix with the thorotrast. The absence of immediate symptoms is explained by the location of the embolus in the carotid artery, which is shown by the arteriograms to be below the circle of Willis. By a secondary thrombosis the collateral circulation has then been shut off with resulting hemiplegia. Naturally, release of the ligature could be of no use under these circumstances.

Case no 6 Neurosurgical clinic 452/35 H V S ♀ 26 years. First admitted Febr 1935. Arteriovenous aneurysm of the left pre-central region, with jacksonian fits involving the right side of the body and slight spasticity of the right hand as chief symptoms. After the arteriograms had shown the presence of a huge arteriovenous aneurysm fed mainly by branches of the anterior cerebral artery, but because of its size and position considered to be inoperable the patient was first given roentgen treatment. Two years later her condition was essentially unchanged except for headache and periodically occurring episodes of weakness of the right hand. She was therefore readmitted to the clinic in Dec 1937. On Dec 16th a ligature was applied to the left common carotid artery. No symptoms followed and on Dec 28th the internal carotid was also ligated. There were no immediate symptoms but 9 hours after

operation the patient rather suddenly became drowsy, the right hand and face became paralyzed and there was a right-sided Babinski. These symptoms developed within 15 minutes and led to immediate removal of the ligature on the internal carotid artery. Consciousness returned immediately after removal of the ligature and within 15 minutes motor power had also returned. A week later the internal carotid artery was again ligated, this time with a strip of fascia, which almost but not completely obliterated the carotid artery. This was well tolerated and the patient left the hospital two weeks later. In her last letter dated October 1943 the patient reports herself well and able to work.

When reviewing these cases one is first struck by the difference in reaction towards carotid ligation between the saccular and the arteriovenous aneurysms. The saccular aneurysms, even those having a supraclinoidal location, tolerated carotid ligation surprisingly well, and only two of the nine supraclinoidal aneurysms showed signs of transient damage to cerebral function. In no case was release of the ligature necessary.

Among the 13 cases of arteriovenous aneurysms no less than 6 showed severe signs of deficient cerebral circulation necessitating removal of the ligature in 5 cases. In one case (No 4) the ligature should also have been removed, but this was omitted, probably because of erroneous interpretation of the symptoms. In one case (No 5) the carotid ligature had nothing to do with the ensuing symptoms which probably were due to embolism during the injection of thorotrast.

Although the supraclinoidal aneurysms fared worse than the infraclinoidal group, it is obvious that the presence of an arteriovenous communication even if the aneurysm is confined within the cavernous sinus is a factor gravely compromising the prognosis of carotid ligation. This is true even in the absence of recent leakage, raised local or general intracranial pressure, deficiency of the general circulation and so forth, factors which are known to increase the danger of carotid ligation. Obviously the presence of an arteriovenous communication is a factor equally important as those mentioned above, for the prognosis of carotid ligation. The mechanism also appears to be quite clear. In the presence of an arteriovenous communication the blood is short circuited and even without carotid ligation signs of a deficient cerebral circulation may be present as for instance in our case no 6. This is particularly true of the large supraclinoidal aneurysms where the arteriograms frequently show that practically

all the blood on the affected side is sucked into the arteriovenous malformation and the normal cerebral arteries except those feeding the aneurysm are not filled at all or show only a faint shadow of thorotrast. The collateral circulation is usually very well developed in arteriovenous aneurysms, which is particularly well illustrated by those cases, where it is possible to fill the aneurysm by injection of thorotrast into the carotid artery of the normal side. Nevertheless it is obvious that the presence of a powerful shortcircuiting mechanism may more than offset the effect of a well developed collateral circulation. The same mechanism is of course present when the aneurysm is situated within the cavernous sinus, although here the danger of compromising seriously the cerebral circulation is considerably less. In other words, an arteriovenous fistula acts in much the same way as a compression of the large arteries of the brain, and carotid ligation may under these circumstances lead to a dangerously low blood pressure in the main arteries of the affected side.

The factors which have been definitely shown to increase the danger of carotid ligation have one common trait, they are all directly or indirectly determined by the nature of the lesion for which ligation is being done and are therefore to a certain extent predictable. Since such unpredictable events as thrombosis at the site of ligation with secondary embolism or vasoconstrictor reflexes arising from the point of ligature can be practically excluded as factors of importance for the occurrence of cerebral damage following carotid ligation, this procedure has lost many of its hazards. It is necessary to examine if other obstructions to the collateral circulation of an unpredictable nature occur with a frequency necessitating serious consideration.

No doubt the interruption of the flow of blood through one carotid artery throws a considerable strain on the collateral circulation through the other carotid and the anterior and posterior communicating arteries. Cerebral ischaemia might result if the collateral circulation is deficient because of anatomical inadequacy of the carotid artery of the other side or its principal connections through the circle of Willis. The vertebral arteries can probably be disregarded in this connection since they are of importance for the blood pressure in the anterior and middle cerebral arteries only under exceptional circumstances. Anatomical inadequacy of the circle of Willis probably exists, but the anatomical variations do not seem to have been studied recently.

According to EHRMAN (8) who examined the circle of Willis in 57 brains, the anterior communicating artery, which is the most important link in the collateral system, was below average size in 7 cases, and occasionally an extremely narrow anterior communicating artery was found. The variations of the posterior communicating artery were even more frequent and EHRMAN concludes that in altogether 24 % of the cases examined the size of one communicating artery was below average. The physiological significance of these observations is difficult to estimate however, since undersize of a communicating artery need not necessarily imply functional deficiency. Although the conclusions which can be drawn from anatomical facts therefore are limited, more accurate information on the variations of the circle of Willis, based on a large number of cases, would be desirable, particularly with reference to complete absence or extremely small size of the anterior communicating artery. The importance of arteriosclerosis and vascular disease of syphilitic origin for the collateral circulation through the circle of Willis must also be considered. So far the necessary data for a statistical valuation of the importance of these factors are lacking. Although the favourable experiences gained with carotid ligation in cases of infracaloidal saccular aneurysm indicate that inadequacy of the collateral circulation through the circle of Willis rarely occurs this possibility should always be borne in mind particularly in the case of elderly patients. Otherwise the danger of carotid ligation can be estimated from the point of view that the most important factor deciding the outcome of the operation is the nature of the lesion, particularly its influence on the cerebral and general circulation.

In infracaloidal saccular aneurysms ligation of the internal carotid artery is a fairly safe procedure, carrying very little risk to life and function. Whether this statement holds good also in elderly patients, above 60 years of age is impossible to say but it is advisable to exercise caution in cases of this type, particularly if there are signs of arteriosclerotic or syphilitic vascular disease. In one of my cases the patient was over 60 years of age and had severe hypertension. Nevertheless ligation of the internal carotid artery was well tolerated, but further experience alone can tell how far the indications for carotid ligation can be extended in cases of this type.

In supracaloidal saccular aneurysms it is impossible to predict with certainty whether ligation of the internal carotid will be

tolerated or not Personally I think it is a wise policy to begin with a ligature of the common carotid artery, to be followed some months later by ligation of the internal carotid Sometimes it will be found that ligation of the common carotid has been sufficient This happened in one of my cases who had a very large aneurysm arising from the anterior cerebral artery When the patient was re-admitted some months later it was found that all the symptoms particularly the central scotoma present on the side of the aneurysm had disappeared, which was thought to indicate that the aneurysm was thrombosed and shrinking It might be argued that ligation of the common carotid might not reduce the velocity of blood stream sufficiently to ensure thrombosis of the aneurysm, and that after some time the collateral circulation has been so efficiently developed, that ligation of the internal carotid is also ineffective in this respect Some of DANDY's experiences and my own experience with case no 2 indicate that this possibility is not entirely hypothetical Further experience is necessary to clear up this point

With regard to the infrachnoidal arteriovenous aneurysms it is quite clear that ligature of the internal carotid alone is not a satisfactory procedure To eliminate short-circuiting the collateral circulation through the arteriovenous fistula a silver clip on the internal carotid immediately above the cavernous sinus would be the logical step This should be done immediately after ligating the internal carotid in the neck The argument against this procedure, which to my knowledge has never been carried out in this one-stage fashion, is of course that it would be well-nigh impossible to remove the silver clip if the collateral circulation should prove to be inadequate In young patients I would hardly hesitate to apply this radical procedure In older patients it is safer first to ligate the common carotid and if necessary let the ligation of internal follow a few months later Sometimes intracranial ligation of the internal carotid may also be indicated and this should then be done as soon as the presence of an adequate collateral circulation has been proved

In the supraclinoidal arteriovenous aneurysms ligation of either the internal or the common carotid artery is definitely contraindicated except as a preliminary step before removal of the malformation This should be done immediately after the carotid artery has been tied in the neck Ligation of the carotid alone has a very doubtful therapeutical value and is a very dangerous procedure



The procedure to follow when a saccular aneurysm, either infra- or supraclinoidal, is complicated by leakage signs of impaired cerebral circulation from compression, or a deficiency of the general circulation is beyond the scope of this paper. Moreover general rules can hardly be laid down for cases of this type where several and variable factors must be considered before deciding upon the plan for treatment.

A good deal has been written about the value of hastening the development of an efficient collateral circulation by periods of manual or mechanical compression of the carotid artery for some time before ligation. In uncomplicated cases of saccular aneurysms pre-operative treatment of this kind appears superfluous and personally I am very sceptical about its efficiency. As a preliminary test for the efficiency of the collateral circulation digital compression of the carotid artery may have some value but it should be borne in mind that digital compression strong enough to occlude the carotid artery might also provoke a carotid sinus reflex producing symptoms which may erroneously be interpreted as signs of a deficient collateral circulation. Likewise direct compression of the carotid artery in the open wound before application of the ligature is of little if any value. In my experience signs of cerebral ischaemia never occur immediately after carotid ligation and usually several hours or even days elapse before such signs appear.

If and when signs of a deficient cerebral circulation occur usually a day or two after ligation, the wound should be re-opened immediately and the ligature removed. So far no ill effects of this procedure have been observed and in several instances the cerebral circulation has been quickly restored.

### Summary.

The experiences of this clinic based on 25 cases of ligation of the carotid artery in cases of intracranial aneurysms confirm the opinion of JEFFERSON and SCHORSTEIN that carotid ligation is a fairly safe procedure in infraclinoidal saccular aneurysms. In supraclinoidal saccular aneurysms our experiences were somewhat more favourable than those reported by SCHORSTEIN. In arteriovenous aneurysms, both supra- and infraclinoidal, the blood is shortcircuited through the arteriovenous fistula, thereby

rendering the collateral circulation after carotid ligation inefficient. Carotid ligation therefore is a very dangerous procedure in cases of this type and should be discarded altogether in supracarotid arteriovenous aneurysms except as a preliminary step to facilitate removal of the lesion. In infracarotid arteriovenous aneurysms the common carotid artery should be ligated first, and the internal carotid ligated later after an interval of some weeks or months. In selected cases it might be possible to ligate the internal carotid directly but if this is done, intracranial ligation of the carotid artery below the circle of Willis should be done at the same time to prevent shortcircuiting of the collateral circulation.

If signs of cerebral ischaemia occur after carotid ligation, the wound should be re-opened and the ligature removed without delay.

### Zusammenfassung.

Die Erfahrungen der Stockholmer neurochirurgischen Klinik bestätigen die Meinung von JEFFERSON und SCHORSTEIN, dass die Karotisligatur bei infraklinoidale sackförmige Aneurysmen gut vertragen wird. Bei supraklinoidale sackförmige Aneurysmen waren unsere Erfahrungen etwas günstiger als die von SCHOPSTEIN mitgeteilten. Bei arteriovenösen Aneurysmen, gleichgültig ob dieselben supra- oder infraklinoidale gelegen sind, wird nach Karotisligatur ein Teil der kollateralen Blutzufuhr durch die arteriovenöse Fistel abgeleitet, wodurch die Gefahr einer zerebralen Ischaemie entsteht. Bei den erwähnten Zuständen ist deshalb eine Ligatur der Karotis interna sehr gefährlich und sollte bei supraklinoidale arteriovenöse Aneurysmen ganz unterlassen werden. Nur als Vorbereitung zu einer in derselben Sitzung auszuführende Exstirpation des Aneurysmas ist eine Karotisligatur zulässig. Bei den infraklinoidalen Aneurysmen sollte die Karotis communis zuerst ligiert werden. Einige Wochen oder Monate später kann wenn nötig die Ligatur der Interna zugefügt werden. In gewissen Fällen kann wahrscheinlich die Interna sofort ligiert werden, es muss aber dann in derselben Sitzung eine intrakranielle Ligatur der Karotis ausgeführt werden, wodurch eine Kurzschliessung der kollateralen Blutzufuhr verhindert wird.

Sollten Zeichen einer Gehirnischaemie nach Karotisligatura auftreten, muss die Ligatur sofort entfernt werden.

### Résumé.

Les expériences de la clinique neuro-chirurgicale de Stockholm confirment l'opinion de JEFFERSON et SCHORSTEIN que la ligature carotide est un procédé assez sûr dans les anévrismes infracélinoidaux sacciformes. Dans les anévrismes supracélinoidaux sacciformes nos expériences étaient un peu plus favorables que celles-ci rapportées par SCHORSTEIN. Dans les anévrismes artérioveineux, et supra- et infracélinoidaux, le sang est dérivé par la fistule artérioveineuse, en rendant la circulation collatérale après une ligature carotide inefficace. La ligature carotide est, par conséquent, un procédé très dangereux, dans les cas de ce type, et doit être tout à fait omise quand il s'agit des anévrismes artérioveineux supracélinoidaux sauf comme un pas préliminaire afin de faciliter excision de la lésion. Dans les anévrismes artérioveineux infracélinoidaux l'artère carotide commune doit être ligaturée la première, et la carotide interne ligaturée plus tard après un intervalle de quelques semaines ou de quelques mois. Dans certains cas la carotide interne peut probablement être ligaturée tout de suite, mais dans ce cas, une ligature intracrânienne de l'artère carotide sous le cercle de Willis devait être faite en même temps afin de prévenir un court-circuit de la circulation collatérale.

Si des signes d'ischémie cérébrale se présentent après la ligature carotide, la ligature doit être enlevée sans retard.

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# The Non-Malignant Pharyngopalatal Tumours and Their Surgical Treatment.

By

Docent STURE RODÉN,  
Stockholm

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In the tonsillar fossae and then vicinity up to the base of the skull, laterally to the mandible, medially into the soft palate and downwards below the tonsillar fossae there are sometimes found non-malignant tumours. In view of their rarity they represent in most hospitals isolated cases which do not allow of a systematic study, and, therefore, the present material appears to me to be of a certain interest.

At Radiumhemmet in Stockholm 11 cases have been treated in the course of the last 12 years<sup>1</sup>. These have been neuromas or salivary-gland tumours (In addition one lipoma and one fibroma have been operated on at Karolinska Sjukhuset). It is particularly the surgical part of the therapy that I now intend to discuss in detail. Owing to their rare occurrence these tumours are very little known and the differential diagnosis is difficult, so reports are given of all the cases.

The *malignant* tumours in this region are also comparatively uncommon. For his dissertation in 1931 BERVEN collected 94 malignant tonsillar tumours which had been treated at Radiumhemmet during the years 1916—1930 (during the same period the number of uterine carcinomas was 2,000).

About half of the tumours now to be considered are mucous- and salivary-gland tumours. In his work of 1935 AHLBOM collected

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<sup>1</sup> I beg to extend my cordial thanks to Professor E. BERVEN, the Chief of Radiumhemmet, for allowing me to use the material and express my appreciation of the instructive co-operation with him and the assistant chief, Docent H. AHLBOM.

the pertinent material of Radiumhemmet, 254 cases. Of the benign tumours he reports 4 in the soft palate and 1 in the hard palate. Of the semi-malignant 2 in the oropharyngeal wall and the tonsillar region.

These tumours dealt with in AHLBOM's work have as a rule been small, they were all treated before 1933 and the operations — enucleation and coagulation — were all performed from inside the mouth. This creates a wound cavity connected with the mouth cavity, the space is limited and in particular the possibilities of checking the haemorrhage are very poor. The larger the tumour, the more obvious are these disadvantages.

One condition for the removal of the tumour by an incision from the outside is that the mucous membrane of the pharynx can be loosened without any very great difficulty and without lesions. This condition existed in the cases here reported.

The approaches indicated for pharyngotomy are numerous. For instance pharyngotomia lateralis according to v. Miculicz offers good access to the region concerned, but the procedure is quite a circumstantial one and is almost too profound an operation for these benign tumours.

When on October 10, 1932, Professor HYBBINETTE for the first time in this country attacked such a tumour from the outside he employed a much simpler method. He just freed the tumour from a section along the edge of the jaw. When one examines these tumours, especially the large ones, the possibilities for this method *a priori* appear very doubtful. Experience has now proved that in most cases the operation is successful. Before summarizing the experience hitherto gained I will illustrate this account by the case reports.

1 5881/32 O M J ♀, born Nov. 11, 1903. Admitted on Sep. 3, 1932.

Since November 1928 she had had a node on the right side of the neck with swelling inside. It had increased steadily without causing any real trouble. During the last month, however, she has had pain radiating towards the ear and a tired feeling in the neck.

Her general condition was good. Behind the right mandibular angle there was a tumour, about 4 × 5 cm. situated behind the tonsillar fossa and causing this to bulge forward. The surface was smooth and even, the mucous membrane normal. Its consistency was elastic, pseudo-fluctuating.

*Diagnosis* Salivary-gland tumour of comparatively benign character.

*Treatment* Teloradium, a total of 24 i g/h at a distance of 5 cm. on 3 fields.

Surgery on Oct 6, 1932 (HYBBINETTE) Large section below the posterior part of the mandible, dissection in towards the tumour. It was difficult to remove, the capsule burst so that tumour masses escaped into the wound. It appeared as if the whole capsule came out, gauze drainage. *Histological diagnosis* (REUTERWALL) *Neurofibroma*, probably not malignant.

71 mg of radium was placed in the gauze bag and allowed to remain for 8 hours. After the treatment the cheek has displayed occasional swelling. Otherwise the patient has been well. The last report is dated Aug 6, 1943.

2 3461/33 E M G ♀, 47 years of age. Admitted on June 11, 1933. In 1928 she was operated on by Dr HYBBINETTE for a benign parotid mixed tumour on the left side. She was quite healthy until 1932 when she began to notice a swelling of varying size at the lower part of the left parotid. On April 12, 1933, she was operated on by Dr HYBBINETTE. The tumour proved to be a defined, cystic formation the size of a hazel nut. The histological examination disclosed inflammatory tissue only. Later on a fresh swelling occurred in this region. This was treated at Radiumhemmet as a recurrence of a tumour. Teleradium at a distance of 5 cm, one field straight towards the tumour and one field obliquely from behind, a total of 25 i g/h. After the treatment oedema developed but no certain tumour. In November Dr HYBBINETTE discovered that the tumour bulged into the pharynx. The tonsillar region, the most lateral part of the soft palate and the wall of the pharynx bulged forward quite distinctly. The tumour was regarded as arising from the pharyngeal process of the parotid.

Surgery on Feb 8, 1934 (HYBBINETTE). A long vertical section was made in front of the ear, the facial nerve was sacrificed and the external carotid was ligated. Total extirpation of the parotid, exarticulation and resection in the lower jaw through —8. The tumour had two protrusions, the anterior one into the pterygoid fossa, the other filling the infratemporal fossa and strongly adherent to the base of the skull, a small part of the capsule of the tumour had to be left.

*Histological description*. The tumour was built like a neurinoma, the nuclei had a distinct palisade position, and, on staining according to v Gieson, the stroma was reddish yellow. No indication of malignancy but it could be well imagined that recurrences might arise from remnants left at the base of the skull. *Pathological-anatomical diagnosis* Neurinoma.

In view of the risk of recurrences from the remnants of the tumour left at the base of the skull teleradium was given from two fields, a total of 48 o g/h. No certain skin reaction. After treatment the patient was free of symptoms with the exception of the facial paresis.

Last examined in November, 1943.

3 6529/34 H S ♀, born 1896. Admitted in Jan 1935.

In adolescence she had numerous attacks of angina and abscesses, which were cut, last in 1918.

Since 1929 she had had a swelling under the left ear and it had grown

slightly. However, it had grown inwards into the throat but had caused the patient no actual discomfort.

Her general condition was good. Below the left ear a tumour measuring  $3 \times 3$  cm, which merged into a tumour in the left wall of the pharynx extending from the nasopharynx down to the tonsil and compressing the tube. The tumour pushed into the pharynx to a few mm from the midline. The surface was smooth, the consistency firmly elastic.

In January 1935, 45 g/h telerradium on 3 fields, in March the tumour had diminished to  $2/3$  of its original size and the mucous membrane was somewhat movable. Owing to a cold she was not operated upon until May 16, 1935, (HYBBINETTE) at Sophiahemmet. The tumour was freed through a section below the edge of the jaw, further details are lacking.

*Histological diagnosis* (REUTERWALL) Parotid tumour of a mixed tumour type with fibromyxochondro-epithelial structures. No signs of malignity.

On March 22, 5 radium tubes of 25 mg were introduced into the wound cavity and allowed to remain there for 10 hours, two up towards the base of the skull, two along the pharyngeal wall, one at the edge of attachment of the ear. They were placed near the pharyngeal wall.

Troublesome reaction during June and July. Difficulty in opening the mouth, pains, deafness. In Nov 1935 almost entirely free from symptoms, so latest on Nov 12, 1941.

4 972/34 A E A ♂, born Dec 15, 1890. Admitted on Jan 23, 1931.

For a couple of years he has had swellings on both the interior sides of the alveolar process of the upper jaw. For about one month the throat has been swollen and he has had difficulty in breathing and swallowing. Cut at Lidköping and referred to Radiumhemmet for a tumour in the soft palate.

His general condition was good.

The right half of the soft palate is pushed considerably forward by a submucous tumour with a somewhat nodular surface. It extends over the midline, pushing the uvula to the left and causing the tonsil to bulge forward. When palpated the tumour is found to be approximately of the size of a hen's egg. It goes up to the posterior edge of the hard palate against which it lies firmly. Laterally it passes into the most posterior part of the bucca and the retromandibular plica, which region bulges forward. Downwards it approaches the mandible and fixes to its periosteum, then proceeds in the direction of the hypopharynx and finishes with a lower pole on a level with the upper edge of the epiglottis. Upwards — nasoscopy — the tumour is observed to push up the tube. The consistency of the tumour is firmly elastic. The overlying mucous membrane is intact.

The tumour was interpreted as being a probably benign, encapsulated salivary-gland tumour, possibly a neurinoma. Its large extent, particularly upwards, made surgery doubtful.

As radium was not available X-ray treatment was given, a total of 2 HED — in thirds — on two fields each. A comparatively trouble

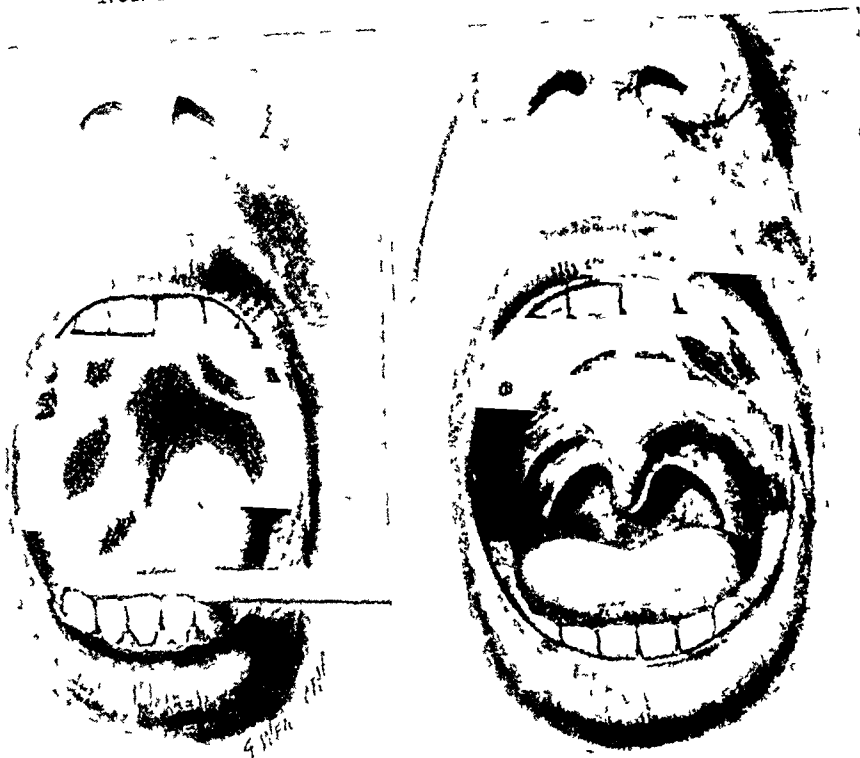


Fig 1 Case 4 before treatment      Fig 2 Case 4 5 years after treatment

some reaction from the pharynx. The size of the tumour hardly decreased.

Surgery on March 9, 1934, by Dr BECKMAN of the Sabbatsberg Hospital. The tumour is dissected with blunt instruments from a section along the edge of the jaw. It is entirely encapsulated and loosens fairly easily. Pathological-anatomical diagnosis: Fibromyxo-epithelioma, non-malignant (REUTERWALL).

The healing proceeded well and the patient was free of symptoms until 1937. At that time a small tumour was extirpated from the scar and was found to be a lymph-gland with tuberculosis.

In Feb 1942 he was given X-ray treatment for an enlargement of the thyroid. This was first suspected to be of a malignant nature but after a few months' observation the suspicions proved unfounded.

In June, 1942, the patient was quite healthy.

5 6081/35 L E N ♀, born June 10, 1899. Admitted on August 15, 1935.

Afflicted with goitre for many years without any actual troubles. For about two years there has been a pea-sized tumour in the right side of the throat. This has proved slightly provocative of swallowing but has given rise to no other symptoms. In March it commenced to grow rapidly and in the course of a fortnight it acquired the size of a plum.



The patient consulted a physician, who recommended surgery, but not until August did she apply to a hospital from which she was referred to Radiumhemmet with the diagnosis heavy enlargement of the right tonsil

Her general condition is excellent. In the right part of the mesopharynx there is an egg-sized tumour bulging heavily inwards which by palpation is found to be situated behind the tonsil. The surface of the tumour is smooth. It extends down to the orifice of the larynx, where it finishes abruptly with a pole. Upwards it diminishes more slowly but does not reach the nasopharynx. The consistency is firmly elastic.



Fig. 3. Case 5 before treatment

The tumour is attached to the underlying tissue but not to the mucous membrane. The vessels there are somewhat congested. Probably a mucous- and salivary-gland tumour.

A few small doses of teluradium are given. The tumour is not sensitive to the radiation. On Aug. 19 biopsy.

*Diagnosis* Neurinoma, which tallies with the duration of two years and the spool-like shape. On Aug. 23 the patient received a preoperative dose of 17 r g/h. On Sep. 20 the reaction had receded, the tumour was unchanged.

On Sep. 28 surgery was performed by HYBBINRTTL. A section below the edge of the jaw. The tumour is attached by 5 nerve strands to the middle cervical ganglion.

*Histology* Neurinoma with no sign of malignity (RLUTERWALL).

After the surgery a Horner syndrome developed. On Febr. 4 the

patient still experienced difficulty in opening the mouth. The Horner syndrome gradually disappeared so that in Nov 1936 the patient considered the vision of the left eye completely restored. According to her own statement she was quite healthy up to Oct 1943.

6 5499/41 J G O ♂, born April 2, 1882

The patient was admitted on April 8. Since 1937 he has felt a swelling in the left side of the throat. The troubles have increased steadily and in May 1940 the throat was entirely obstructed. The physician consulted pronounced it to be a quinsy. The patient states that this burst spontaneously after which the swelling diminished slightly. He has, however, felt a thickening in the throat and has talked thickly the whole time. No difficulty in swallowing nor in breathing through the nose. No ear troubles. At the end of March a biopsy in the hospital disclosed a mixed tumour of myxoendothelial type with no definite encapsulation. The patient was then referred to the Ear Clinic of Karolinska Sjukhuset.

General condition good. The peritonsillar region of the left side is occupied by a tumour almost double the size of a walnut, extending up into the whole left part of the soft palate. The uvula and the tonsil are heavily dislocated to the right. The area immediately around the tumour is oedematous, no definite lateral margin. The tube on the left side unchanged. The surface of the tumour is somewhat uneven, the overlying mucous membrane pale in several places with signs of a commencing necrosis. Teloradium treatment in three fields on the left side with 5 doses of 900 r on each. In addition 2,000 r X-ray on a field on the right side. The tumour was not particularly sensitive to radiation but remained comparatively unchanged at the beginning of July. A small flat gland behind the mandible had appeared. Surgery on July 11 by the author. Intubation narcosis. Narkotal + ether +  $N_2O$  +  $O_2$ . A curved section behind and below the left mandibular angle. The tissue was sclerotic so that a knife had to be used all the way, further, there was an unusual number of comparatively large vessels. The palpated gland was removed separately. Having arrived well inside the mandible a blunt dissection is possible up to the tumour, which is pressed out by an assistant. Owing to the sclerosis and the oedema the space is restricted and it is difficult to loosen the tumour, the capsule bursts, but it would appear that the whole tumour is extirpated. One drainage tube, suture.

*Histological diagnosis* (SANTESSON) Semi-malignant basaliomatous fibromyxo-epithelial mucous- and salivary-gland tumour.

The healing proceeded normally but a certain swelling of the area of operation and in the throat remained for about 3 months. Since then the patient has had no symptoms of the tumour but has been troubled by a skin lesion below the left ear which showed an ulceration as late as March 1944.

7 6986/41 E E A ♀, born Aug 3, 1915. Admitted on May 9, 1941.

In her youth she had frequent colds and felt a thickening in the throat. Tonsillectomy performed in 1933. From the beginning of 1941

again felt a thickening in the throat and she experienced slight difficulties in swallowing. She had been mildly subfebrile but had had no actual pains. In the middle of April she consulted a doctor. As the swelling did not change she was referred to the Ear Department of Karolinska Sjukhuset.

Her general condition was good. On the right side of the mesopharynx there was a tumour about the size of a walnut, not sensitive to palpation. It extended from the palatal arch to the posterior wall of the pharynx and a short distance down into the pharynx. The mobility of the pharyngeal wall was normal. In the mucous membrane over the tumour an ulceration of about 1 cm diameter was beginning to develop in the foremost part of the tumour. In the trigonum caroticum there was a bean-sized gland suspected to be a metastasis. The tumour was interpreted as a tonsillar sarcoma, and X-ray treatment was started. After two treatments of 300 r biopsy was carried out, no tumour tissue was obtained, nor was any found in a later biopsy. The patient was given a total of 3,000 r on two fields during May. The tumour showed a slight decrease in size but the diagnosis was still uncertain. At the end of July it was considered that it was a case of salivary-gland tumour or neurofibroma and the patient was transferred for surgery. As in the previous cases the radiologists proposed extirpation from the outside. As the tumour could not be palpated exteriorly it was agreed that it should if possible be extirpated from the pharynx (Aug 13, O ARNELL). It proved that the tumour extended too deep to render this course possible.

On Aug 15 the surgery was performed (O ARNELL). Intubation narcosis with nitrous oxide. Section from the mastoid process to the hyoid bone. The posterior belly of the digastric muscle with the hypoglossal nerve was pushed upwards, the large vessels backwards. The superior laryngeal nerve was exposed and immediately below this was found a well defined tumour of the size of a dove's egg which was dissected with blunt instruments. No changed glands could be observed. One drainage tube, suture. The postoperative development was normal but a Horner's syndrome remained.

The tumour was of the size of a walnut and well encapsulated.

*Histological diagnosis* (REUTERWALL) Well defined neurinoma comparatively poor in cells, no signs of malignity.

Free from symptoms when examined in January 1941. No radiation treatment after the operation.

S 1660/42 K II II ♂, born March 1, 1905. Admitted on Jan 29, 1912.

Five years before he was operated on for a quinsy on the left side. It was cut 6 times before it receded. Then a hard swelling developed in the palate and has remained unchanged ever since. It has caused him no discomfort except in the case of throat infections, when it has given rise to slight troubles in swallowing.

He first sought admission into the Ear Department and was referred from there to Radiumhemmet.



Fig 4 Case 8 before treatment

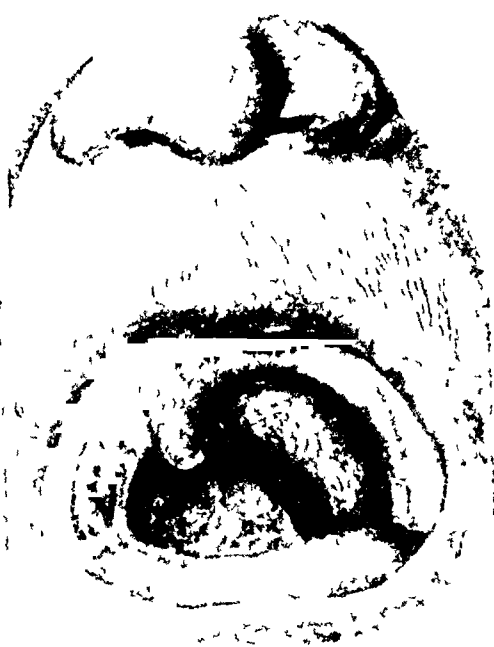


Fig 5 Case 10 before treatment

General condition good. An oval tumour the size of a hen's egg occupies the left part of the soft palate and extends comparatively far down the left side of the throat. Its lower pole is visible when the tongue is pressed down, its upper pole lies on the border between the soft and the hard palate. Laterally the tumour reaches the inside of the mandible. The mucous membrane appears unchanged. The consistency of the tumour varies considerably with both soft and hard parts.

With the aid of a rhinoscope it is possible to see how the tumour extends up to the attachment of the septum on the posterior wall, the left tube is dislocated and compressed. There would appear to be a groove between the pharyngeal tumour and the nasopharyngeal one. It is doubtful whether it is two different tumours. Biopsy was performed in both places without obtaining any definite diagnosis. Preoperative X-ray treatment was commenced, given in one field on either side. In all 1,650 r on the right and 2,000 r on the left side in doses of 300—350 r. Considerable reaction. The patient could not take solid food for 14 days. 30 days later the tumour had decreased somewhat in size and a certain granulation on the anterior surface could be observed more clearly than before. It was now regarded as a comparatively well encapsulated mucous- and salivary-gland tumour.

Surgery on March 23 by the author. Intubation, anaesthetic, ether,  $N_2O$ . A section behind the edge of the jaw. The tumour was soon

reached. It loosened easily, owing to its size there was hardly sufficient space to move forwards but after the section had been lengthened it was not difficult to remove it in its entirety. It was covered by a thin capsule, the section surface varies from glassy to white opaque here and there vessels and haemorrhages were observed. Histological diagnosis (REUTERWALL) Benign fibromyxo-epithelial mucous- and salivary-gland tumour.

After the operation it proved that the tumour in the nasopharynx was an adenoid and the swelling subsided. No radiological postoperative treatment. The subsequent development was satisfactory. Free from symptoms in November 1943.

9 9551/43 R S H ♂, born Feb 6, 1922. Admitted on May 12, 1943. During his whole life he has had frequent colds.

In 1941 the patient noticed that the left tonsil grew but this caused no trouble. After an angina in 1942 tonsillectomy was performed and it was then established that a tumour had developed. The patient consulted the out-patients' department of Karolinska Sjukhuset on April 4. He then had a firm tumour well the size of a dove's egg in the left tonsillar region. Biopsy displayed a neurinoma, probably a malformation, no grounds for malignancy. He was referred to Radiumhemmet.

May 12. General condition not satisfactory, tired. The left tonsillar region is occupied by a tumour mass forming a fleshy disk about 3 cm in diameter. In the middle of it there was a small hole, probably caused by biopsy. The tumour mass is broad laterally and runs up into the soft palate to the hard palate, downwards it can be followed as far as can be reached with a finger. Retro-mandibularly one bean-sized and two pea-sized glands are found forming a firm pack. Preoperative X-ray treatment in one field on either side, a total of 2,500 r on each side.

The tumour decreased in size on July 15, after the reaction had subsided, the tumour appeared still to be fixed to the mucous membrane to a comparatively great extent. As it was nevertheless considered possible to enucleate it, surgery was performed by the author on July 21. Intubation narcosis, ether, N<sub>2</sub>O. Section behind the edge of the jaw. The tumour, covered by a capsule, is exposed below the parotid, after which blunt instruments are employed to loosen it. Anteriorly it is fairly firmly fixed and here the capsule bursts after which it has to be removed piece by piece. As far as can be felt this procedure is entirely successful. Gauze bag + tamponade. Skin suture.

On the day after the operation the patient was unable to swallow but had no difficulty in breathing. No swelling of the pharynx could be seen when inspected. The swallowing trouble diminished gradually during the week after the operation.

Description of tumour. A number of pieces, the largest with a capsule. tissue variegated, looks like a mucous- and salivary-gland tumour. Microscopic examination. Neurinoma with a moderate number of cells rich in wide and partly thrombotized vessels. Slightly atypic cells, and also some slightly polymorphous cells and nuclei. No mitoses observed. In the sections the tumour is seen to be surrounded by connective tissue.

arranged like a capsule In places necrotic parts, also oedema Moderate infiltration of plasmolympho-leucocytes Pathological-anatomical diagnosis Neurinoma moderately rich in cells, no signs of malignity (SANTESSON)

During the autumn the patient still experienced some trouble from the pharynx and had an oedema, he was subjectively free of symptoms and in December only some insignificant cicatricial streaks were palpated in the operation field

10 13902/43 P E L ♂, born June 19 1880 Admitted on Sept 2, 1943

As long as he can remember he has had difficulty in swallowing, the food has stuck in the throat and sometimes part of it has been hawked up Diverticulum pharyngis(?) Owing to fits of dizziness he went to the medical polyclinic, and a tumour in the left part of the soft palate was discovered From the Ear Department the patient was subsequently referred to Radiumhemmet

General condition comparatively good In the left tonsillar region and the left part of the soft palate there was a pear-sized tumour bulging inwards The overlying mucous membrane reddened The tumour constricts the entrance of the larynx and displaces the uvula to the right The tumour is firm, roundish, fairly movable, but fixed to the lateral wall No certain metastases can be palpated

Preoperative X-ray treatment on one field on the right side 7 times 100 r, one field on the left side with 8 doses of in all 3,100 r One field over the left half of the face was given 8 doses totalling 3,050 r

Moderate reaction, the tumour hardly changed at all The patient, however, was fairly exhausted and the mucous membrane healed slowly so that surgery could not be performed until the end of November

Dec 1 Surgery (the author) Intubation narcosis A 5 cm long section below the maxillary angle After the platysma has been cut, blunt instruments are used inwards to the tumour A pair of scissors are used to cut the last piece in to the capsule after which the dissection is commenced This goes fairly well in spite of the narrow space At the top some stretched strands form an obstacle The tumour, which is not quite as large as a hen's egg, is then prized out with a pair of scissors and a grooved probe It bursts and a couple of pea-sized tumour masses are pressed out These are removed secondarily A severed nerve stem continued down the neck from the upper end of the wound, probably the ramus descendens of the hypoglossal One small drainage tube, suture

On the day after the operation the condition was satisfactory, the patient had the usual troubles in swallowing but no difficulty in breathing In the evening he was given 0.50 medinal in an anal suppository and 1 cg morphia subcutaneously In the afternoon and evening nothing remarkable was observed At 10 p.m. the patient was asleep and breathed normally, at 11.30 p.m. he was dead and already displayed post-mortem staining The autopsy disclosed that the operation cavity was filled with a clot about the size of a hen's egg, severe oedema and

extravasation of blood around the larynx, particularly on the left side. Oedema in the laryngeal mucous membrane and the glottis. The cause of death was a glottis oedema, occurring acutely about 35 hours after the operation.

*Specimen* Macroscopic description Tumour the size of a hen's egg, delimited by a thin capsule of connective tissue. The section surface white, partly gelatinous, in one pole a walnut-sized area with a central hole and papillary excrescences towards it. Microscopic description The tumour is surrounded by a capsule of connective tissue. It consists mainly of sclerotic connective tissue poor in cells. In places a plexiform structure can be observed. Accumulations of cells noticeable here and there in the tumour. In one or two places nuclei situated as in a neurinoma. No signs of malignity.

Pathological-anatomical diagnosis Neurinofibroma

11 17290/43 A. B. J. ♀, born Dec 9, 1898. Admitted on Dec 6, 1943.

Five years ago the patient had a swelling in the right side of the throat. A gargle was prescribed by a physician and her throat improved. Had no troubles but happened to show her throat to a doctor, who discovered a tumour.

She was referred to Radiumhemmet. On admission on Dec 6 she was strikingly pale but otherwise her condition was good. In the place of the right tonsil a greyish red soft insensitive tumour slightly larger than a walnut which pushes the palatal arches forward. The overlying mucous membrane intact. Probably a mucous and salivary-gland tumour. X-ray treatment 300 r twice on one field on the right side and 5 times 400 r on the left side in the direction of the right tonsil. On the right side telerradium was also given on 2 fields, 3,600 r on each. At the end of December she had a high temperature and difficulty in swallowing. In February strong skin reaction in the fields of treatment. At the end of February she was operable. The surgery was performed in the Ear Department.

Surgery on Feb 26 (HAMBERGER). Section along the right sternocleidomastoid muscle. It was easy to reach the vessels on a level with the branching of the common carotid. The common facial vein is divided. The vessels are drawn laterally. Dissection is performed inwards to the pharynx and the tumour is reached. It appears to be well defined. The lower pole is loosened with a pair of scissors. The upper pole, which reaches the base of the skull and laterally appears adherent to the vessels, is loosened with a blunt instrument. When the tumour is seized with a forceps it breaks. The whole tumour is removed. It is somewhat larger than a tangerine and appears to be entirely covered by a capsule. At the top of the wound cavity there is an inconsiderable haemorrhage, it is impossible to establish the source, so the wound cavity is tamponed. One tube in the lower part of the cavity. Sutures. No injury to the mucous membrane of the pharynx. On March 7, 1911, she had quite a considerable oedema on the outside, but conditions in the throat were normal.

Pathological-anatomical diagnosis (RLUTERWALL) A well defined encapsulated neurinoma of tangerine size with oedematous and necrobiotic changes and haemorrhages in central parts No signs of malignancy No tumour metastases were found in the lymphatic glands in the specimen

*Symptomatology* The most striking feature of the anamnesis in these cases is the inconsiderable trouble caused by the tumours even when they are big In three cases there have been occasional slight troubles in swallowing, in one also difficulties in breathing In the majority of cases the tumours have been discovered by chance in connection with an examination of the throat

As a rule the diagnoses have originally been tonsillar tumour-sarcoma, endothelioma, etc In most cases, however, a close inspection discloses that the tumour lies laterally and behind the tonsil, causing that region and the tonsillar folds to bulge forwards The overlying mucous membrane is generally of normal appearance, sometimes slightly reddened and congested In the case of large tumours it is stretched over the tumour but always free from it Even where ulcerations or wounds have occurred it has been possible after these have healed to remove the mucous membrane with a blunt instrument without any lesions resulting

The centre of the tumours would appear to be a point laterally and somewhat behind the upper tonsillar pole From there they develop in all directions but mostly up- and downwards, thus attaining an oblong shape Upwards the base of the skull forms the boundary In those cases where an X-ray examination has been made no destruction has been observed here Downwards they extend a little below the lowest part of the tonsillar fossa The mandible forms the lateral boundary, in some instances the tumour has been well developed also below this Medially the tumours have in some cases reached over the midline Frequently it is difficult to determine the size (see Case 11) All the tumours have been well defined and encapsulated Most of them have had a smooth even surface, but in some instances it has been knobby in various places, in one of these cases the consistency also varied considerably with soft and hard parts mingled However, most common is an elastic consistency, sometimes pseudo-fluctuating All the tumours were stated to be insensitive to palpation Clinically some tumours have given the impression of being affixed to the vicinity, generally the base of the skull, once to the mandible In spite of this they have loosened comparati-



very easily when removed. Only in Case 2 is the tumour stated to have been found actually affixed to the base of the skull when the operation was performed. Biopsy was performed 7 times in 5 cases with positive results in 2.

Macroscopically the tumours were built as mucous- and salivary-gland tumours, also the neurinomas, which could not be distinguished in this manner. As a rule the capsule is thin. The surface of the section is generally variegated with brownish-yellow to yellowish-white gelatinous masses alternating with purely gelatinous and white opaque parts. Hollow spaces occur, their walls may be smooth but also covered with papillar excrescences. The histological examination has in 7 cases disclosed the picture of neurinoma, in one case quite rich in connective tissue. In the other 4 cases the picture was one of fibromyxo-endothelioma. No certain signs of malignity could be detected. The age of the patients varied from 21 to 63 years.

*Treatment.* All the tumours have been given a combined radiological and surgical treatment. The radiological treatment has been preoperative with a total dosage between 5,000 and more than 8,000 r. In two of the earliest cases radium tubes were also introduced into the wound cavity. The radiological treatment has caused many of the patients severe and tedious troubles owing to pronounced reactions from the skin and the mucous membrane. With regard to the surgery performed after the treatment this has certainly in some cases been easier than if no preoperative treatment had been given. The tumours have decreased in size and have become more easily movable. In other cases the reaction around the tumour, entailing sclerosis, oedema and an increased blood flow, have rendered the operation more difficult.

On the whole the X-ray treatment will probably not influence the difficulties of surgery. As it is practically impossible clinically to determine the degree of malignity and as in the case of semi-malignant and malignant tumours primary surgical therapy gives poorer results than when combined with preoperative radiation therapy, radiological preoperative treatment in small doses can be recommended.

All the tumours have then been removed, in one case a trial was made to remove the tumour from the inside but this failed and the tumour, like all the others, was removed from the outside. The procedure has been to work inwards to the tumour from a section along the edge of the jaw as a rule with blunt instruments.

and then to prize it out. In most cases it has been fairly easy to loosen it. In one case a total extirpation of the parotid was carried out, the lower jaw being resected. In another the section was made along the sternocleidomastoid muscle and the vessels were first denuded. No haemorrhages worth mentioning have occurred (Except in Case 10). Apart from troubles in swallowing during the first few days the postoperative history has presented no complications. In one case (No 10), however, the last one operated upon by the author, the patient died 35 hours after the operation oedema developed in the glottis and the patient died in his sleep. In two cases a temporary Horner syndrome occurred. In Case 2 the facial nerve was deliberately sacrificed. As may be expected no recurrences have appeared. Five of the cases have been observed for at least 8 years, two for 3 years, one for two years and one for one year.

*Discussion* Among the non-malignant tumours in the lateral parts of the pharynx neuromas and fibromyxoeipitheliomas appear to be predominant. They often appear as tonsillar tumours, and giving hardly any trouble they are often discovered merely by chance. A thorough inspection discloses the tonsillar fossa and the tonsil to bulge forwards. The mucous membrane is generally stretched but not fixed, frequently it has a normal appearance and is seldom reddened. A thorough bimanual palpation should always be done in these cases and it is especially important to try to determine the extent of the tumour along the throat. Rhinopharyngoscopy should be used for this purpose. If the tumour reaches the base of the skull this should be X-rayed. In the case of tumours occurring below the edge of the jaw an inspection of the throat should not be neglected.

It is very difficult to carry out effective biopsies of these tumours. They should be avoided also in view of the fact that the resulting wound postpones surgery.

The treatment should be surgery and in clinically not decidedly benign cases it may be wise to give preoperative radiotherapy. Intubation narcosis is of great value. Correctly given it does not enhance the danger of glottis oedema. The surgery should not be performed from the inside. Firstly, this creates a larger or smaller wound cavity connected with the pharynx, secondly the access is very limited and there is no chance of controlling a haemorrhage effectively. It has proved comparatively easy to remove these tumours with blunt instruments — in spite of the many times

apparently hopeless nature of the problem — and the mucous membrane has not broken. If the section is placed along the edge of the jaw the scar will be less visible, if placed along the vessels there is a better possibility of checking the haemorrhage. As no very great haemorrhage has hitherto occurred, I am of opinion that the operation should be started with a section along the edge of the jaw, if necessary this can be extended downwards. If an assistant presses out the tumour from inside the mouth the removal is sometimes facilitated. Even if the haemorrhage from the incision is slight, a careful drain should be applied in view of the danger involved by even a slight secondary haemorrhage (Case No. 10). Frequent inspections should be made of the pharynx after the operation to ensure that the cavity is not filled out too much. On account of the danger of suffocation great caution should be observed in the administration of morphine after the operation.

### Summary

The author describes 11 of these very uncommon tumours: 7 neurinomas and 4 mixed tumours of the salivary gland type. They cause the patient but little trouble and it is frequently very difficult to determine the type of tumour clinically. All the tumours now described were benign and little sensitive to radiation. In some of the cases the surgery was probably facilitated by the radiation treatment, in others quite the contrary. In cases that are not assuredly benign the author considers pre-operative roentgen treatment advisable. Surgery should be performed from the outside, which is far easier than might be expected. Intubation, narcosis, good drainage and proper supervision after the surgery are important in order to ensure good results.

### Zusammenfassung

Veif beschreibt 11 dieser sehr seltenen Tumoren: 7 Neurinome und 4 Mischgeschwülste (mixed tumors of the salivary gland type). Sie verursachen kaum Beschwerden, und die klinische Bestimmung des Tumortypus ist oft sehr schwierig. Samtliche hier beschriebenen Tumoren waren gutartig und wenig strahlenempfindlich. In einem Teil der Fälle durfte die Operation durch die Strahlenbehandlung wohl leichter geworden sein, in anderen Fällen das

Gegenteil In nicht sicher gutartigen Fallen erscheint es Verf wohlbedacht, praoperative Rontgenbehandlung zu geben Die Operation ist von aussen her vorzunehmen, was viel leichter ist, als man denken sollte Intubationsnarkose, gute Drainage und sorgfaltige Uberwachung nach der Operation sind fur einen guten Erfolg von Bedeutung

### Résumé.

L'auteur décrit onze de ces tumeurs très rares, à savoir 7 neurinomes et 4 tumeurs mixtes (tumeurs mixtes du type de celles de la glande salivaire) Elles causent à peine de troubles, et il est souvent très difficile de déterminer cliniquement leur type Toutes les tumeurs décrites ici étaient bénignes et peu radio-sensibles Dans quelques cas, à l'inverse, l'opération a été, à vrai dire, facilitée par la radiothérapie Dans les cas où la bénignité n'est pas certaine l'auteur juge prudent d'administrer un traitement préopératoire aux Rayons X L'opération doit se faire par la voie externe, ce qui est plus facile qu'on ne pourrait le croire La narcose par intubation, un bon drainage, et une surveillance convenable après l'intervention sont importants si l'on veut obtenir un heureux résultat

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From the Surgical Service of The Serafimer Hospital  
(Head Prof G SÖDERLUND)

## Spinal Anesthesia for Thoracoplasty.

By

OSCAR SCHUBERTH

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Not so long ago it was taken for granted that thoracoplasty should be performed under local anesthesia, this being regarded as involving the least risk of postoperative complications. During the last years modern general anesthetics (evipan,  $N_2O$ , cyclopropan) have come into use more and more.

To a certain degree even spinal anesthesia has been used. BETTMAN and BIESENTHAL reported 80 cases in 1930 and FLICK 7 cases in 1931. In 1935 NEWTON published his experiences from 28 thoracoplasties on 16 patients under spinal anesthesia induced with 0,25 Gm of novocain. The anesthesia proved to be excellent. A reduction in blood pressure of 30—40 mm was noted in all the cases not receiving ephedrine prophylactically, otherwise a lesser degree. The pulse rate was as a rule unaffected. Four of the patients showed slight "air-hunger", which disappeared after they received ephedrine and carbogene and were put in Trendelenburg's position. Vomitting was exceptional and the shock less than with patients operated upon under local anesthesia +  $N_2O$  or avertin.

SHIELDS (1935) reported 55 low thoracoplasty operations done under spinal anesthesia with no complications, and though he regarded the method physiologically unsound on account of its effect on the respiration, he found it worth using.

Even GURD, WINEBERG and BOURNE (1938 and 1939) recommended the method on the basis of their experience in 42 cases. They had, however, two deaths on the operating table, as well as three slight respiratory complications.

MILLER, SCHAFFNER and HILTZ (1940) who earlier used  $N_2O + O_2$  + avertin changed over to spinal anesthesia, which they have used in 170 cases, and in a later article SCHAFFNER and FOUND (1942) reported 335 cases. They said that spinal anesthesia more closely fulfills the requirements of the "ideal" anesthetic for thoracoplasty than any other forms in use today.

SEMB (1941) believes that spinal anesthesia is combined with greater risk of effects on the circulation and respiration than local anesthesia, stating that it should be used only in operations on the lower ribs and in corrective plastic surgery.

Among those who are sceptical as to the value of this method are ALEXANDER (1937), who considers that it incurs increased risk of spreading because of the decreased ability of coughing (diaphragmatic paralysis), BEECHER (1940), who considers it to be of value only in cases of bronchial fistula if diathermy is called for, and CRAFOORD (1944) and HEIN (1938).

After observing two cases of spreading when thoracoplasty was done under evipan +  $O_2$  +  $N_2O$  anesthesia, I began in 1941 to use SEBRECHT's spinal anesthesia, at first with low, later also with high thoracoplasty. I had earlier had good experience with this form of anesthesia in cases of pleural empyema as well as in one case of diaphragmatic hernia operated on trans-thoracically.

Since then I have used spinal anesthesia for most all thoracoplasty operations. 70 operations on 39 patients. *Technique* One hour before the operation  $\frac{1}{2}$ —1 cg of morphine + 0.2—0.4 mg of scopolamine. Spinal anesthesia according to SEBRECHT with selective closing, during the last year all injections have been made with the patient in the lateral posture, since the needles are not of such good quality as before, and apt to break when the patient changes position. Ten to 30 cc have been required for sufficient anesthesia. It has been shown repeatedly that it is different to force the anesthesia up to the higher thoracic segments. As a rule, therefore, it has taken some time to give the anesthetic. When sufficient insensibility has been reached and the needle removed, the patient has been placed in a prone position with the arms forward and upward. This position has shown itself to be most advantageous. In higher as well as lower thoracoplastic operations it provides good access to the operative field and the patient lies steadily and still. It is far easier to hold aside the scapula than when the patient is in a lateral position.

In some cases it has been necessary also to use a local anesthetic in the upper wound angle. Should even this fail to produce complete freedom from pain, the patient has been anesthetised with narcotal. Table I shows the results as follows

Table I

	No of cases	complete painless-ness	L A necess	narc necess	no record
Op on 1—3rd ribs dorsally	30	16	8	6	—
» » 4—7th » »	31	19	4	5	3
» » 8—11th » »	4	4	—	—	—
» » 1—4th » ventrally	5	1	2	2	—
	70	40	14	13	3

Nausea and sickness occurred only three times. They are therefore far more rare than during laparotomies.

Drops in blood pressure were usual. The conditions in the 36 cases in which the blood pressure was recorded are seen from table II.

Table II

Reduction to	< 90	< 80	< 70	< 60
Number of cases	28	19	8	3

As is typical of spinal anesthesia, the blood pressure falls were combined with an unaltered pulse rate or bradycardia. Anxiety has never been caused through the blood pressure decrease. Occasionally intravenous drip was given during the operation.

Disorders of the respiratory centre have never been observed. In two cases temporary cyanosis was observed. In one it was obviously caused by paradoxical respiration and it disappeared when the thoracic wall was sutured. In the other case it disappeared immediately the patient was placed in the dorsal position. In both cases a considerable decrease in blood pressure was observed.

Two deaths occurred

1. 807/43, ♀ aged 44. Epilepsy, tuberculous salpingitis. Bilateral lung lesions of tuberculous appearance with several small cavities on the right side. Operation on 5/5 43 (SCHUBERTH). Spinal anesthesia to Th VI. Local anesthetic failed to produce painlessness. Narcotal. Typical resection of first to third ribs. Operation on 20/5 (SCHUBERTH). Spinal anesthesia gave only relative anesthesia. Local anesthetic hardly better. Narcotal. Typical resection of fourth to eighth ribs. 25/5 vomiting and slight abdominal pains. 25/5 increased pain. Intestinal disten-

sion X-ray shows small intestinal ileus Operation (SCHUBERTH) Spinal anesthesia Greatly dilated small intestine and large number of adhesions Lysis 29/5 sudden death

2 284/44, ♂ aged 36 Left-sided cavity the size of an orange On right side moderately spread spotty and linear lesions of tuberculous appearance Operation on 4/2 1944 (SCHUBERTH) Spinal anesthesia, in spite of addition of 40 cc of local anesthetic, did not produce complete insensibility, and narcotical was given 5/4 Dyspnea and cyanosis Temperature 39.9/38.9 C 6/2 rapid decline Blood transfusion without result Death

In both cases, which were operated upon on wide indications when other therapy was considered useless, the spinal anesthesia during the thoracoplasty had obviously nothing to do with the fatal outcome

### DISCUSSION.

With the great demands now put upon the effect of an applied anesthetic, it is natural that ordinary local anesthesia is regarded as being insufficient Though in an experienced hand it can often induce complete insensibility, the result is all too often unsatisfactory It is therefore strange that spinal anesthesia has not been attempted more often The explanation must lie in the disinclination to use a method of procuring insensibility which can in high degree affect the respiration and circulation of these already greatly affected patients How, then, does the spinal anaesthesia affect the patients in these respects?

The *respiration* can possibly be affected through paralysis of 1) the respiratory centre 2) phrenic nerve and 3) intercostal nerve

It is doubtful whether spinal anesthesia ever has any influence on the respiratory centre Proof hereof is lacking in every case, and it seems highly improbable that the slight novocain concentrations which reach the cisterna magna and are further diluted there, can produce any such effect

Of more serious nature is the threat of phrenic paralysis The respiration paralysis which occurs with spinal anesthesia is without doubt caused through the anesthetic reaching to the phrenic roots The question is, then, if through careful anesthetic technique one can prevent spreading to the neck region even when the upper thoracic segments must be anesthetised My experience is that this is possible SEBRECHT's method with selective dosing permits careful control of the height reached by the anesthetic



It is striking how difficult it has been in our cases to induce the anesthetic to rise to the upper thoracic segments. It should also be borne in mind that it takes stronger concentrations of anesthetic fluid to paralyze motor nerves than sensory nerves, a circumstance which gives an extra certainty if the sensibility reduction is carefully registered.

As the anesthetic must reach up to the first thoracic segments, the intercostal muscles must be put out of action notwithstanding the latter fact. Is this then of any significance to the respiration? From the author's earlier investigations (SCHUBERTH 1936) it is evident that diaphragmatic breathing fully compensates for the reduction which can be brought about through intercostal muscle paralysis. It must also be remembered that as a result of the complete rest to which these spinally anesthetized patients are subjected, oxygen demands are less than those of patients undergoing other methods of anesthesia (SCHUBERTH 1936).

One is therefore brought to the conclusion that the *risk of influence on the respiration is no indication against* the use of spinal anesthesia during thoracoplasty.

There is far more danger of influence on the *circulation*. One must be prepared for considerable blood pressure reductions. Earlier investigations have shown, however, that these reductions are not so serious as posttraumatic or post-operative shock, and that they are easily adjusted through changing of position or intravenous fluid infusion. Our experiences with the 70 anesthetics bears out these statements.

There are therefore no serious reasons *against* the use of spinal anesthesia. Are there then any causes *for* appropriating this method? Even if local anesthesia must be regarded as unsatisfactory, does not evipan and  $N_2O$  give the best anesthesia? This question must yet be left open. I, myself, have not had sufficient experience with general anesthetics, and can therefore express no opinion. On the other hand, since spinal anesthesia has been shown to be an excellent method during thoracoplasty, a method which creates calm and good working conditions, with inconsiderable post-operative effects on the patients, I see every cause for continuing with it and advise further trials. It is necessary, however, that the person who gives the anesthesia is fully in command of the technique and, to begin with, it is advisable to use the method in operations on the lower thorax.

### Summary.

1 A short review is given of previous authors' experience with spinal anesthesia for thoracoplasty

2 Seventy thoracoplastic operations in which spinal anesthesia according to SEBRECHT was used are reported, 35 of which involved the first to third ribs. Temporary drops in blood pressure but no respiratory disorders were observed. Only 3 cases of nausea were noted.

3 The method is recommended for continued trial.

### Zusammenfassung.

1 Eine kurze Übersicht von den Erfahrungen früherer Verfasser mit Spinalanästhesie für Thorakoplastik wird gegeben.

2 Es wird von 70 thorakoplastischen Operationen, in welchen Spinalanästhesie nach SEBRECHT verwendet wurde, berichtet, von welchen 35 die erste bis zur dritten Rippe einschlossen. Zufälliges Fallen des Blutdruckes aber keine respiratorischen Störungen wurden beobachtet. Nur 3 Fälle von Übelkeit wurden bemerkt.

3 Die Methode wird für weitere Versuche empfohlen.

### Résumé.

1) Brève revue des cas antérieurs où la rachianesthésie fut employée dans la thoracoplastie.

2) Compte-rendu de 70 rachianesthésies selon SEBRECHT, dont 35 pour l'intervention sur 1—3 côtes. Il y eut des chutes passagères de la tension artérielle, mais jamais de troubles de la respiration. Nausées dans 3 cas.

3) L'auteur recommande qu'on continue d'essayer la méthode.

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# On the So-called "Hypertrophy" of the Prostate Combined with a Sclerosis, and the Cause of the Retention in Lesions of the Prostate.

By

AXEL LENDORF, M D ,

sometime Chief surgeon at the Danish State Hospital,  
Prof in the University of Copenhagen

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In this article I propose to deal with the cause of disturbances in micturition in case of hypertrophy and other diseases of the prostate followed by retention, such as I probably made it clear already in 1912 (1), next I propose to call attention to a peculiar form of hypertrophia of the prostate, the diagnosis and treatment of which is dependent precisely on an exact knowledge of the cause of micturition disturbances and the retention in the diseases of the prostate

All surgeons are aware that even if it is the rule that the bigger the hypertrophic prostate is the sooner it will cause a retention, but they also know that there are cases with a large retention and a relatively small prostate. It must be emphasized that these cases do not comprise the so-called "atrophy of the prostate" (sclerosis of the prostate), "Prostatisme sans prostate", with the formation of a so-called valve or barrier at the internal orificium, but the prostate itself is enlarged, and the cases show the peculiarity that the atrophic processes and the sclerosis are found together with the so-called hypertrophy of the prostate. In these cases, therefore, there is a formation of adenomas from the submucous accessory glands besides a sclerosis of the musculature of the prostate, and here it is the downwards situated submucous glands which proliferate, forming a subvesical hypertrophy.

In these cases, which it is highly important to know, particularly in order to be able to give them the right treatment, the diagnosis hypertrophy is the most frequent, because the clinical

picture corresponds closely to this disease and the prostate is felt to be slightly or moderately enlarged by exploration per rectum. The most striking fact, which indeed may seem somewhat peculiar, is that this slight hypertrophy is able to cause such a grave disturbance in the micturition. But precisely this fact should make the surgeon suspect that he is not concerned with a simple hypertrophy, and if the cause of micturition trouble due to lesions in the prostate is known it will not be difficult to explain the great retention.

I therefore propose first to deal with this question supported by the investigations made by me in 1911 and 1912 (1) Anatomical investigations, macroscopic as well as microscopic, of more than a hundred prostates from embryos to very old men, were then made, further endoscopic examinations of normal individuals as well as of patients with enlargement of the prostate and patients in whom a prostatectomy had been performed. These investigations have been published previously (2) besides certain experiences gained during 30 years of prostate surgery. As these publications may not be known to the readers of this journal I shall recapitulate the most important facts touching the question of the micturition. The anatomic investigations dealt with the musculature of the prostate as well as the glandular tissue in normal individuals and in patients with enlargement of the prostate, and the function of the prostate during the micturition was made clear by urethroscopy by irrigation.

Instead of first describing the muscles and glands of the prostate, I prefer to deal with these anatomical facts in connexion with the results as seen by urethroscopy by irrigation at the opening and closing of the prostatic part of the urethra during micturition at the same time adding some facts which, I think, will be of practical interest to the surgeon.

When no micturition takes place the walls of the prostatic part of the urethra are close together, and difficult to separate. This is apparent, for example, by an X-ray examination with injection of contrast through the external orificium of the urethra at this examination the prostatic part appears like a very narrow stripe — as well known.

During micturition the whole prostatic part of the urethra changes its shape completely. The whole prostate moves, and the movements which are made, and the form assumed by the prostatic cavity, correspond very closely to the anatomy of the

muscles The whole cavity dilates and takes the form of a funnel which is widest at the upper end When open, the internal orificium will be triangular, almost like an equilateral triangle with one angle in front, but it may in some cases be like a card heart, the uvula forming a slight prominence at the middle of the posterior wall of the triangle The internal orificium being triangular when open is observed and described ten years later by YOUNG and WESSON (3) However, anybody will easily be able to observe these movements by urethroscopy by irrigation, but it will be necessary to use an urethroscope, by which the whole circumference of the prostatic part of the urethra is visible, as by rectoscopy with STRAUSS's rectoscope, I made use of GOLDSCHMIDT's urethroscope with the tube which is generally used to see the anterior urethra, viz the straight tube

First the bladder is filled with water and the patient is then asked to make water and hold water alternately, during which the prostatic part is examined in its entire length The movements seen of the smooth musculature are movements following and started from the striated muscles of the perinæum, which is felt to move simultaneously

When then the patient is asked to make water and the internal orificium opens, it will be the posterior wall which moves backwards, while the anterior does not move The triangular shape shows that it is an active opening of the internal orificium and not — as previously believed — a passive relaxation of the internal sphincter yielding to the pressure of the detrusor muscle

The orificium is opened by the longitudinal bundles of the detrusor muscle continuing downwards into the prostate, partly by the thin internal stratum, which is situated inside the internal sphincter, and called by many authors the trigonal muscle, partly and more particularly by the strong external stratum which interlaces between the bundles of the sphincter on the base of the prostate

Below the internal orificium the prostatic part dilates during the micturition so that it forms a cavity which is completely circular in cross section The colliculus and the crista disappear completely or form a comparatively small longitudinal prominence in proportion to the lumen on the posterior wall By increasing the irrigation tension when the internal orificium is partly open, the cavity dilates further posteriorly just below the prominent posterior wall of the internal orificium which is formed by the posterior

part of the internal sphincter, which now stands like a muscle barrier against the bladder cavity

The central circular muscle, the continuation of the sphincter internus downwards, is here very weak or completely absent, and this is the reason why the prostatic cavity is able to widen posteriorly, corresponding to the colliculus' and the ducts from the prostatic glands and ejaculation ducts, in this way the prostatic cavity gets a comparatively great volume such as is probably the case during sexual intercourse by which it is completely closed above and filled with sperma and secretion from the prostate. On a dead body of a man with a normal prostate it will also be possible to see this cavity, limited upwards by the barrier formed by the internal sphincter when shortly after the death a formol solution is injected into the bladder through the urethra. The smooth musculature, which is not yet dead, contracts by the irritation caused by the formol, the effect being greatest in the places where the muscles are strongest. The barrier formed by the internal sphincter will protrude, a great excavation will be formed to the rear below the sphincter in the place where the circular muscles are almost absent, further downwards the lumen again becomes smaller where the smooth central circular musculature just above the external sphincter is stronger again.

These facts may be explained as follows. The circular muscles in the prostate, which may be regarded as a continuation of the stratum medium of the bladder, consist of two layers: the internal stratum, the vesico-prostatic sphincter, and the external circular bundles.

The vesico-prostatic sphincter is situated just outside the inner longitudinal layer and just inside the real glandular tissue of the prostate, the two lateral lobes, thus limiting their inner surface. The internal vesical sphincter is formed of the upper part of this circular stratum, its upper bundles lying completely horizontal, as is easily seen on dissection and by a horizontal section right-angled to the axis of the urethra, gradually the bundles change their direction, passing from upwards posteriorly — downwards anteriorly around the urethra. Posteriorly this circular layer of muscles only reaches to a point slightly above the colliculus, while anteriorly it extends through the whole length of the prostate. Corresponding to the colliculus and the opening from the ejaculation ducts and prostate glands this circular muscular layer is completely lacking. Below this place, however,

towards the apex of the prostate the sphincter is formed posteriorly, and in such a way that also here we get a ring with horizontal bundles right-angled over the axis of the urethra. By a section right-angled to the axis of the prostatic part of the urethra we therefore only find a continuous ring of muscles above the colliculus towards the bladder and downwards towards the apex of the prostate.

When the patient is told to detain the water, thus making a contraction of the whole vesico-prostatic sphincter, the oblique course of the bundles below the upper part will cause a slight downward movement of the posterior circumference of the orificium. When the patient makes water, the sphincter relaxes and the longitudinal detrusor bundles from the bladder down into the prostate contract, the posterior circumference of the orificium moves a little upwards and backwards.

The lower circular bundles of the vesico-prostatic sphincter, which are situated just above the striated external sphincter (the compressor urethrae) are of great importance in the prostate surgery, keeping the continence after a prostatectomy or a trans-urethral resection for hypertrophia prostatae. It must be emphasized that a striated muscle as the external sphincter will not be able to make such a permanent contraction. After such operations the internal orificium remains open for a long time, forming an open communication between the bladder and the upper part of the prostatic cavity, as seen by the author by urethroscopy and retrograde cystoscopy after suprapubic prostatectomy, and described by him more than thirty years ago (1).

In my opinion the sporadic incontinence after a perineal prostatectomy depends upon a lesion of this lower part of the smooth sphincter, which easily happens when the urethra membranacea is opened at the external sphincter and the apex of the prostate in order to introduce YOUNG's retractor. To avoid this lesion I therefore make use of a long retractor introduced through the external orificium of the urethra. It looks like YOUNG's retractor with two wings unfurling in the bladder, the form being slightly modified the wings forming a greater angle to the handle in order to make introduction easier. The muscles of the perinaeum around the urethra membranacea and the apex of the prostate will not be touched. The urethra is only opened corresponding to the prostatic part above the edge of the prostate with an incision through the posterior wall here. After having removed the long



retractor, the short one (YOUNG's) is introduced through this incision, through which the enucleation of the adenomas also takes place. The whole technique by this operation is described elsewhere (2, 4). In this way there will be no risk of later incontinence.

Besides the inner circular layer, the vesico-prostatic sphincter, external circular bundles are formed. These external bundles are found all over the external surface of the prostate. The lateral lobes are thus completely surrounded by a thin layer which forms part of the proper capsule. Anteriorly, in the anterior commissure, they unite with the central bundles. The original glandular tissue of the prostate is situated between the external and the internal circular bundles, thus forming the two lateral lobes with the ducts around the colliculus. The glandular tissue, which posteriorly is situated above the ejaculating ducts, between these and the sphincter, is part of the two lateral lobes which meet here in the middle line. As can be seen on prostates from embryos the glandular tissue has developed from the epithelium of the urethra in the neighbourhood of the utriculus, and grown into originally compact muscular tissue around the urethra. This glandular tissue has broadened to each side upwards and downwards thus dividing the muscular tissue into two layers, the central layer, forming the vesico-prostatic sphincter, and the peripheral layer towards the proper capsule. Anteriorly the masses of glandular tissue do not meet. The two circular layers remain united, forming the thick and high anterior commissure.

The movements of the wall of the prostate during the different phases of micturition correspond very closely to the arrangement of the muscles as described above, also at the colliculus and downwards. The lumen corresponding to the colliculus and downwards is in the urethroscope seen to narrow when the patient keeps water, but at the same time the form changes, the colliculus and the crista protrude more and more, finally causing the whole lumen to assume the form of a horse shoe with the convexity anteriorly, as is well known from the cross-section through the urethra on the dead body. The change of form of the lumen from circular during micturition to horse-shoe shape when closed and contracted depends precisely — as already described — on the absence of the internal sphincter, corresponding to the colliculus and the crista, and upon the closing being caused by the peripheral circular bundles round the glandular tissue. Thus it must be considered proved that the wall of the prostate moves

in its whole thickness during micturition. If the internal sphincter had been present in this place, the lumen would have remained circular during the closure, as is the case above at the internal orificium when this is closing, and also further downwards towards the apex of the prostate, where the internal sphincter is present again posteriorly and where we see the lumen remain circular all the time during the closure.

The micturition thus demands a great active mobility of the walls of the prostate. If the muscles of the prostate are hindered in these movements, micturition troubles arise. And this is exactly what has happened in all these cases of lesions of the prostate calling for operative treatment on account of retention. The lack of this mobility causes micturition trouble not only in cases of the so-called hypertrophy, but also in the case of the so-called atrophy (sclerosis), and in cases of cancer of the prostate and acute prostatitis with retention, the hindrance, however, being caused by widely different processes.

In the case of the so-called hypertrophy of the prostate the adenoma masses from the submucous accessory glands, which are found throughout the whole prostatic part spread, as is well known, in the wall of the prostate (1). The adenoma masses push aside the muscles situated inside the original prostate gland, the weak longitudinal internal detrusor bundles will spread, the whole vesico-prostatic sphincter is dilated, more and more gradually as the space between it and the mucous membrane is filled with stiff and immobile masses. For that reason there will only remain weak rests of the longitudinal internal muscle fibres after the enucleation, the sphincter on the other hand lying clean and collected in its whole extension. The course of the sphincter bundles in the cavity thus remaining is clearly demonstrated on formol-treated specimens from an enucleated prostate, where the development of the adenoma masses inside the real prostate gland is, of course, also made clear.

This is, however, not so easily seen in the above-mentioned place posteriorly where the sphincter is lacking.

The adenomatous masses developing into the prostatic wall thus make it rigid and immobile, and in this manner the muscles are unable to carry out their function during micturition. This is clearly shown by urethroscopy by irrigation. The internal orificium is now not seen to open and close in the manner described, nor are the movements and changes in form of the prostatic walls above

described demonstrated when the patient is asked to make or to hold the water. The lumen is all the time seen as a cleft between two rigid vertical walls of rock, which do not change their form. This devastation of the function of the prostatic walls during micturition is the cause of the micturition trouble in these patients. This explains why it is impossible for the patient to make water although the lumen of the prostatic part is larger than normal, and the thickest catheters are able to pass the urethra. The earlier theories according to which the prostate only played a passive rôle during micturition and the micturition trouble was ascribed to purely mechanical disturbances, viz. the formation of a valve or a barrier, deviation of the posterior urethra on account of noduls, besides BUSCH's theory, hold good no longer. One exception exists: a petiolate lobe which as a valve covers the internal orificium, if no other formation of adenomas exists the removal of such a middle lobe will make the micturition free.

In the case of the so-called atrophy (sclerosis) of the prostate with retention the cause of the micturition trouble is exactly the same, the rigidity of the prostatic wall. In this case the musculature itself is ill, whereas this is not the case in hypertrophy of the prostate, in which the musculature is only hindered in moving the walls by the adenomas which have developed, but will regain its normal function when the appropriate treatment, the removal of the adenomas, is carried out. In the case of sclerosis, the smooth muscles have degenerated, and been replaced by immobile connective tissue. Most frequently the sclerosis involves the upper part of the prostate, the upper part of the vesicoprostatic sphincter, the internal sphincter in its posterior circumference being transformed to an immobile barrier of connective tissue, which at urethroscopy by irrigation presents itself like a projecting roof over the prostatic cavity which does not retire by attempts to make water. The lower part of the prostatic sphincter, however, keeps able to function to the full extent. This part of the sphincter provides for the continence when the barrier is removed by means of electrocoagulation, causing an open communication between the cavities of the bladder and the prostate, as in other cases of transurethral electroresection.

In case of cancer of the prostate or acute prostatitis with retention the micturition disturbances also depend upon the walls of the prostate being rigid, in the former case on account of the cancerous, in the latter on account of the inflammatory infiltration.

Reverting to the special kind of hypertrophy of the prostate here dealt with, it should be emphasized that, consequently, we are here faced with two causes of the rigidity of the wall of the prostate and hence the micturition trouble, and it is now made clear that this trouble may be relatively considerable without the hypertrophy being very large. It is not the subvesical adenomas alone which make the wall of the prostate immobile but also the sclerosis upwards.

The removal of the adenomas alone is not sufficient to make the micturition normal in this kind of hypertrophy, as will be seen from the following case history (from 1918)

A 70-year-old man, who for a couple of years had suffered from prostatic micturition trouble, had a retention of about 8—900 cm<sup>3</sup> on an average, by exploration per rectum he presented a moderate hypertrophic prostate. No prominence of the prostate into the bladder was found by cystoscopy. By perineal prostatectomy typical adenomas were removed, altogether as much as a big chestnut. As expected it was the question of a subvesical hypertrophy. By passing the finger into the bladder the internal orificium was, however, felt to be remarkably narrow and not so yielding as is normally the case.

At that time I did not realize the nature of these mixed cases and took no further steps. The micturition, however, did not become free, after the operation there was a retention of 2—300 cm<sup>3</sup> on an average, increasing gradually and steadily, resulting in readmission into hospital 18 months after the operation. Introduction of a catheter was difficult and by urethroscopy a hole of the size of a pea was found in the "roof" of the prostatic cavity, which at any rate was not narrowed downwards. Only now and then the catheter was able to find the opening into this diaphragm, the degenerated sphincter. A total perineal prostatectomy with the technique described by me elsewhere (2) was performed. The operation was difficult because the retractor could not be introduced. After removal of the whole prostate, which mainly consisted of relatively firm fibrous tissue, the upper end of the membranaceous urethra was sutured to the now wide opening of the bladder. The micturition had become normal and has been so since.

This case conveyed the impression that the sclerosis had increased considerably after the removal of the adenomas. In such cases where, after removal of the adenomas, the finger introduced in the bladder felt the internal orificium narrow, I have later on in the same stage removed the sclerotic tissue. When doubtful as to whether there was any sclerosis I have removed the posterior circumference of the internal sphincter, but in cases where it has been clear, I have made a total perineal prostatec-

tomy at once. So I do in cases where it is impossible to find any cleavage after the incision into the posterior wall of the prostate or which otherwise make one suspect a sclerosis or an early cancer.

The possibility of being able, at any time during the course of a perineal prostatectomy, to change over from an intended prostatectomy (adenomectomy) to a total removal of the prostate is one of the advantages offered by the perineal operation as compared with FREYER's operation, where this is impossible. The perineal operation must — in my opinion — be the normal method in the case of hypertrophy of the prostate.

These mixed cases, which doubtless must be included in "the fibrous prostate" of the English, who look upon them as a clear-cut clinical entity with no relation to the pathological picture as it only indicates a prostate which it will be impossible to enucleate by FREYER's operation, I believe to be relatively frequent, and in cases of subvesical hypertrophy with a relatively considerable retention the surgeon should always bear them in mind.

If FREYER's operation is made in such cases, especially in two stages, as often used in this country, the surgeon will get into trouble, the operation being impossible to carry through. From above it is impossible to enucleate the adenomas without having first removed the sclerotic internal sphincter, and this is impossible in an only tolerable surgical fashion even though one has a very strong finger and nail. The knife and the scissors must be used. In other words, THOMSON-WALKER's open operation with instruments under the control of the sight, in these cases even as a total prostatectomy, has to be done. But this operation demands a large incision through the abdominal wall and the bladder, which it is impossible to make in these cases without having first removed all the infected cicatricial tissue, which will weld the abdominal wall to the bladder around the suprapubic opening. No other explanation will be necessary to understand what this means to a patient who was judged too weak to stand a common FREYER's operation in one stage.

Not will the transurethral electroresection be suitable in these cases. Sufficient tissue from the sclerotic internal sphincter may be removed but it will hardly be possible to remove the adenomas further downwards to an extent sufficient to give a lasting effect.

The surest treatment in these cases as well as in extended sclerosis without adenomas and in the case of cancer is the perineal total prostatectomy with the technique previously described (2).

When this operation is made under parasacral anesthesia, whereby considerable bleeding is avoided and the surgeon is able to orientate, it is as easy an operation as the adenomectomy, and the patients stand it well

### Summary.

Supported by anatomical and endoscopic investigations the function of the prostate during micturition is shown. The arrangement of the muscular and glandular tissue is demonstrated. The sphincter is not the internal sphincter alone, but a continuation of this muscle extends right down to the situated external sphincter. The entire smooth sphincter is called the sphincter vesico-prostaticus, and it is the lower part of this which after prostatectomy and resection where the internal sphincter is left open, provides for continence for a long time. The detrusor muscle of the bladder continues right down into the prostate and opens the internal orificium actively during micturition. When no micturition takes place the walls of the prostatic cavity are close together. During micturition the entire prostate dilates. It becomes like a funnel. The internal orificium becomes triangular, yielding to the tension of the longitudinal bundles of the detrusor muscle, the sphincter vesico-prostaticus relaxing at the same time. This normal active mobility of the prostatic walls in their whole extent is necessary for micturition to take place in the normal manner.

The devastation of this mobility is the cause of the micturition trouble with all its deleterious consequences, and such a devastation takes place in all the ordinary prostatic lesions with retention, but on a different pathologic-anatomical basis. All the old theories ascribing the micturition trouble to purely mechanical disturbances no longer hold good.

In the case of the so-called hypertrophica prostatae the walls become immobile because adenomatous masses have developed.

In the case of sclerosis of the prostate (atrophy of the prostate) the walls become immobile because the muscular tissue degenerates and is transformed into immobile connective tissue.

In the case of cancer the walls are made rigid by the cancerous cell infiltration.

In the case of acute prostatitis with retention the rigidity is caused by inflammatory infiltration.

The importance of an exact knowledge of these conditions is seen clearly not least in the special form of hypertrophy of the prostate where in addition to formation of adenomas there is a sclerosis of the musculature (hypertrophy at the same time as atrophy) It should be realized in these cases that the micturition trouble depends on both It is not sufficient in these cases to make prostatectomy (adenomectomy) alone, also the sclerotic tissue will have to be removed, the operation to be performed will as a rule be a *total* prostatectomy This is best done as a perineal prostatectomy, under parasacral anesthesia Reference is made to the author's earlier works on this subject

### Zusammenfassung

An der Hand anatomischer und endoskopischer Untersuchungen wird die Funktion der Prostata während der Harnentleerung aufgezeigt Die Anordnung des Muskel- und Drüsengewebes der Prostata wird klargelegt Der Schliessmuskel ist nicht nur der Sphincter intern allein, sondern dieser Muskel reicht bis in den quergestreiften Sphincter extern hinab Der ganze glatte Schliessmuskel wird Sphincter vesico-prostaticus genannt, und es ist der untere Teil desselben, der nach Prostatektomie und Resektion, wobei der Sphincter intern offen gelassen wird, auf lange Zeiten die Kontinenz ermöglicht Der Detrusor der Blase erstreckt sich bis hinab in die Prostata und öffnet beim Urinieren aktiv das Orificum internum Wenn keine Harnentleerung stattfindet, liegen die Wände der Cavitas prostaticae dicht aneinander Bei der Harnentleerung erweitert sich die ganze Prostata Sie wird trichterförmig Durch Zusammenziehen der longitudinalen Detrusorbündel bei gleichzeitiger Erschlaffung des Sphincter vesico-prostaticus wird das Orificum internum dreieckig Diese normale aktive Beweglichkeit der Prostatawände in ihrer ganzen Ausdehnung ist notwendig, damit die Harnentleerung normal vor sich gehen kann

Die Zerstörung dieser Beweglichkeit ist die Ursache der Harnentleerungsbeschwerden mit allen ihren deletären Folgen, und eine solche Zerstörung der Beweglichkeit der Prostatawände findet bei allen gewöhnlichen Prostataleiden mit Harnverhaltung statt, aber auf verschiedener pathologisch-anatomischer Grundlage Alle die alten Theorien über rein mechanische Vorgänge als Ursache der Entleerungsbeschwerden sind unberechtigt

Bei der sogenannten Prostatahypertrophie wird die Beweglich-

keit aufgehoben, und die Wände versteifen sich infolge Einlagerung der adenomatösen Massen in die Wand

Bei Sklerose der Prostata (Prostata-Atrophie) wird die Beweglichkeit aufgehoben, weil das Muskelgewebe degeneriert und sich in unbewegliches Bindegewebe verwandelt

Bei Cancer ist es die canceröse Zelleninfiltration, die die Wände versteift

Bei der akuten Prostatitis mit Harnverhaltung ist es die entzündliche Infiltration

Die Erkenntnis dieser Tatsachen ist nicht zum wenigsten bedeutsam bei der besonderen Form der Prostatahypertrophie, wo neben der Adenombildung auch eine Sklerose der Muskulatur (Hypertrophie zusammen mit Atrophie) vorkommt. Hier muss man darüber klar geworden sein, dass die Beschwerden bei der Harnentleerung beiden Ursachen zuzuschreiben sind. Es genügt hier nicht, nur eine Prostatektomie (Adenomektomie) vorzunehmen, das sklerose Gewebe muss auch entfernt werden, in der Regel muss eine *totale* Prostatektomie durchgeführt werden. Dies geschieht am besten auf perinealem Weg und unter Parasacralanästhesie. Es wird auf frühere Arbeiten des Verf. darüber verwiesen.

### Résumé.

Les fonctions de la prostate au cours de la miction sont exposées sur base de recherches anatomiques et endoscopiques et le dispositif des tissus musculaire et glandulaire dans la prostate est mis en évidence. Le muscle constricteur n'est pas le sphincter interne seul, mais ce muscle se poursuit et descend jusqu'au sphincter strié externe. Le muscle lisse constricteur dans son ensemble est dénommé sphincter vésico-prostatique et c'est la partie inférieure de celui-ci qui, après la prostatectomie et la résection qui laissent le sphincter interne ouvert, assure pendant longtemps la continence. Les faisceaux longitudinaux du muscle de la vessie se poursuivent en descendant jusque dans la prostate et ouvrent lors de la miction l'orifice interne de manière active. Quand l'évacuation n'a pas lieu, les cloisons de la cavité prostatique se rejoignent étroitement. Durant l'évacuation, toute la prostate se dilate. Elle forme un entonnoir. L'orifice interne prend la forme d'un triangle par suite de la traction des faisceaux musculaires longitudinaux, cependant qu'en même temps, le sphincter vésico-prostatique se détend. Cette motilité active normale des parois



prostatiques est indispensable pour permettre à l'élimination urinaire de s'effectuer normalement

L'endommagement de cette motilité occasionne la difficulté de vider la vessie avec toutes ses conséquences délétoires, et un tel endommagement se produit pour toutes les souffrances prostatiques avec rétention mais sur des bases pathologo-anatomiques différentes. Toutes les anciennes théories sur les causes de la dysurie dans des circonstances purement mécaniques sont sans fondement.

Sous les effets de ce que l'on appelle l'hypertrophie de la prostate, la motilité disparaît et les parois deviennent raides par suite d'infiltration des masses adénomateuses.

Lorsqu'il y a sclérose prostatique (atrophie prostatique), la motilité se trouve éliminée du fait que le tissu musculaire dégénère et se transforme en tissu conjonctif inflexible.

Lorsqu'il y a cancer, c'est l'infiltration de cellules cancéreuses qui raidit les parois.

S'il y a prostatite aiguë avec rétention, c'est l'infiltration de caractère inflammatoire qui provoque ce résultat.

L'importance de connaître ces faits se manifeste également et en particulier pour la forme spéciale de l'hypertrophie prostatique où, en dehors de la formation d'adénomes, il y a également de la sclérose dans la musculature (hypertrophie doublée d'atrophie). Il est important ici de se rendre compte que la dysurie doit être attribuée à ces deux faits à la fois. Il ne suffit pas en l'occurrence de procéder seulement à la prostatectomie (adénomectomie), en effet, il est nécessaire également d'éliminer le tissu scléreux et, en général, d'entreprendre la prostatectomie *totale*. Celle-ci s'effectue de préférence par la voie du périnée et avec anesthésie paracéle. Voir les ouvrages antérieurs de l'auteur à ce sujet.

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From the Møre and Romsdal County Hospital, Molde, Norway  
(Surgeon-in-chief Dr med II FR HARBITZ)

## Thoracoplasty in Pulmonary Tuberculosis.

### Course and Results in 109 Cases

By

H FR HARBITZ

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The present series consists of 109 cases of pulmonary tuberculosis operated on by me during the five year period from 1938 to 1943. Most of the patients were referred from the Reknes Sanatorium, a number from other homes for tuberculous patients in the county of Møre and Romsdal. Thus the series represents quite ordinary, unselected cases from one part of the country.

The *indications* for operation consisted of relatively stable and quiescent cavernous forms of pulmonary tuberculosis, mostly in the apex or upper part of one lung (81 cases), sometimes bilateral with cavernous apical affection on one side and pneumothorax or oleothorax, extrapleural pneumolysis or thoracoplasty carried out on the other (11 cases), and finally tuberculous empyema (17 cases).

Apart from the cases of empyema, which were usually secondary to pneumothorax, it was required that pneumothorax had been attempted and likewise that tubercle bacilli persisted in the sputum. The operation was put off as much as possible for a calm period with relatively little expectoration and a low, stable sedimentation rate. However, a high sedimentation rate and a large amount of expectoration were not considered contraindications in themselves if the condition showed no signs of improving otherwise and the case seemed suitable for thoracoplasty.

*Operative technic.* In cases of cavernous tuberculosis in the lungs *partial thoracoplasty with apicolysis* according to the principles and technic of HOLST and SLMB were performed.

*Anesthesia.* All the operative stages in all the cases were done under local paravertebral anesthesia. Occasionally a small amount

of ether was given by the open method in the later stages of operations for empyema

Apical or upper lobe thoracoplasty was done generally with the resection of five to seven ribs. It was deemed sufficient as a rule to remove down to one rib below the cavity (posteriorly). If it was thought that five ribs were enough, it was attempted to do the operation in one sitting. Otherwise only the upper four ribs were resected in the first stage as a rule and the others in one or two more stages. Three or four weeks were usually allowed to pass between the first and second stages.

An ordinary curved paravertebral incision was used, the same one in both the first and second stages. First a segment of the third rib, not too large, was resected and afterwards nearly the whole of the second rib and the entire first rib. If the patient was in good condition, as was generally the case, a small part of the fourth rib was removed posteriorly.

The apicolysis was performed by dividing the band-like adhesions over the brachial plexus and cutting the posterior periosteum, the intercostal nerves and vessels according to the four upper ribs and any adhesions from the apex upwards and inwards, after which the pulmonary apex was pushed down. The periosteum of one or two ribs was loosened anteriorly, and posteriorly the lung and pleura were stripped away from under the next, fifth rib. This method allows as radical apicolysis as desired. The apicolysis is extrafascial posteriorly and outwards and more extrapleural medially and anteriorly.

The operation wound was irrigated and filled with physiologic salt solution and closed immediately. A soluble sulfanilamide compound was added to the fluid in the wound cavity. The filling of the wound cavity with salt solution may be thought to stabilize the lung to some degree during the first period after the operation and thereby facilitate respiration and coughing.

At the second stage the incision is made in the old scar and the scapula with muscles pulled aside. The newly formed fibrinous coating over the wound cavity is excised and clots and fluid dried up. Then the other ribs are removed as planned as well as further pieces of the third and fourth ribs, large parts of which were left at the first operation to support the thorax. The anterior part of the third rib, in particular, seems to contribute much to the stability of the thorax. After the resection of the ribs the wound is again irrigated with salt solution and then

closed around a small rubber drain which is allowed to remain for 12 to 24 hours. Careful bandaging is done with elastoplast and a cushion placed in the infraclavicular fossa so as to give as much support as possible to the operated half of the thorax, hinder paradoxical movements and allow free motion of the healthy half of the thorax. This all seems to be of great importance.

Resection of the upper seven ribs causes the scapula to fall in, producing good and certain collapse of the lung, but it also sacrifices a great deal of pulmonary tissue. In order to spare lung tissue and at the same time produce strong lateral compression by the scapula, in some cases I resected only six ribs and resected the apex of the *scapula*.

The greatest difficulties were encountered in *obliterating the large apical cavities*. In a number of these cases I resected the *transverse process* in addition to making a radical operation. In some cases I also carried out a *secondary anterior operation* removing cartilage and pieces of rib anteriorly. In occasional stubborn cases I also resected the *clavicle* to increase the lateral compression, apparently with some effect.

In a few bad cases I followed the suggestion of SEMB and performed as a first stage a relatively minor, more or less "test operation", resecting the upper ribs from the front.

In cases of *basal cavities*, of which there are 2 in my series, I recommend total thoracoplasty without apicolysis as a rule. This causes much surer collapse of the lower part of the lung than only partial thoracoplasty in the lower part.

In two cases of *residual cavities*, roentgen treatment was tried, but it had a doubtful effect.

*After treatment* The patient is made to half-sit in bed. I used a so-called peritonitis bed which enables elevation of the upper part of the body and knees. Immediately after the operation one liter of salt solution is injected intravenously. If signs of shock is seen later on in the day, which seldom happens, a blood transfusion is given at once. In my experience, no purely postoperative shock responds so promptly and well to blood transfusion as that after thoracoplasty. During the first week after the operation all the patients are given sulfanilamide drugs by mouth, most recently sulfathiazole. When the postoperative course is uneventful, the patient is allowed to get up after two weeks.

As a rule three or four weeks are allowed to pass between the first and second operation. When the patient is not strong after

the first operation the second stage was put off until everything was in order. After the operation all the patients are given the usual sanatorium treatment elsewhere.

*Infected wound cavities* are first punctured, then usually opened and drained. In the great majority of cases staphylococci were seen in smears and the wound healed in reasonable time with ordinary drainage, after which further operation, if needed, was done according to plan. In one case late tuberculous infection occurred in the wound. Radical revision of the wound was done with diathermic excision of its walls, and it was attempted to collapse the cavity with clavicular resection and other means. The result was good. The infected cavity closed and healed in three months, and the patient has later been cured.

*Tuberculous empyema* is operated on according to the following principles. Closed empyema showing no secondary infection is treated with radical thoracoplasty to the extent necessary, generally total thoracoplasty. Apicolysis is done if the pulmonary disease indicates it.

Fistulous, secondarily infected empyema is first thoroughly drained, preferably with resection of ribs anteriorly and laterally to leave place for the future thoracoplasty wound. Then radical thoracoplasty is done in at least two stages. If the pleural cavity does not close and the secretion persists, "pleurectomy" is done. The thoracic wall around the fistula, often consisting of regenerated ribs and bone plates, is removed again and the whole lateral wall of the persisting pleural cavity is radically cut away. If possible the layer of granulation tissue over the lung is also excised with a diathermy knife. Drainage is then performed. The operation is large and difficult, and may cause considerable shock, but seems to be the only way to obliterate a residual pleural cavity. I have not used ordinary aspiration drainage in these chronic cases as I do not think it of any use.

### Nature of the Series

The sex and age distribution in the 109 cases was as follows:

Age	Men	Women	Total
Under 20 years	3	3	6
20—29 years	23	17	40
30—39 years	23	20	43
40—49 years	15	4	19
Over 50 years	1	—	1
	65	44	109

There was a distinct preponderance of males, especially in the fourth decade

I have divided the cases into three groups

*Group I* Mainly *unilateral* disease in the apex or upper part of one lung (2 cases in the base), 81 cases

*Group II* *Bilateral* disease with cavernous affection in one lung apex and pneumothorax or oleothorax, extrapleural pneumolysis or thoracoplasty done on the other side, 11 cases

*Group III* Tuberculous *empyema*, 17 cases

### I Unilateral Disease 81 Cases

These cases were comprised of 46 men and 35 women. The right lung was involved in 37 cases and the left in 44.

As regards the division of the operation into one or more stages, the distribution was as follows:

25 patients	were operated on in 1 stage	— 25 operations
50	» » » » » 2 stages	— 100 »
6	» » » » » 3 »	
	or with atypical operations	— 17 »
<hr/>		
81 patients		142 operations

In the 25 single stage operations the following rib resections were done together with the apicolysis:

<i>Ribs</i>	1—3	1—4	1—5	2—5	7—11
<i>No of cases</i>	3	5	15	1	1 basal

One of the three patients with only three ribs resected was cured after the operation, although further intervention had been planned. In the two other cases the operation was not completed because of complications after the first stage. One patient had besides a cavity in the apex an old infiltration in the lower part of the same lung. This affection was deemed stable and without risk. Following the operation he got total atelectasis in the operated lung, and later on a cavernous tuberculous disease developed in the lower part. The other died ten months later of tuberculous meningitis and miliary tuberculosis after several unsuccessful attempts to drain a residual cavity.

In 4 of the 5 cases where four ribs were removed the patient became entirely cured, but in one case where more stages were planned the patient died after the first operation.

In the majority of single stage operations five ribs were resected. The operation proved to be adequate in all these cases, all the patients recovering afterwards. In one case the first rib was left by mistake and the second to fifth ribs resected. It proved to have no effect on the result, which was excellent. The first rib fell in and inclined steeply downwards, and the apex fell far down and inward.

In addition the group includes one partial basal thoracoplasty for a basal cavity, also followed by recovery of the patient.

Thus in 22 of the 25 cases of single stage partial thoracoplasty with resection of five or less ribs combined with apicolysis (except for one basal case) the patient became well, free of bacilli and capable of work. The time of observation varies up to five years. One patient died after the operation and in two cases the operation was not continued with further stages as planned. One of the two patients died ten months after the operation from military tuberculosis and tuberculous meningitis.

In the two stage operations the following rib resections were done together with apicolysis:

<i>1st stage — ribs</i>	1—3	1—3	1—4	1—4	1—4	1—4	1—5
<i>2nd stage — ribs</i>	4—6	4—7	5	5—6	5—7	5—8	6—7
<i>No of cases</i>	5	2	1	16	19	6	1

There were altogether 50 patients and 100 operations. This was the main type of operation used. The complications and results will be discussed later.

## II Bilaterally Treated Pulmonary Disease 11 Cases

2 patients operated on in 1 stage	2 operations (1 dead)
7    »            »    »    » 2 stages	14 operations
2    »            »    »    » 3 and 5 stages respectively	8    »
11 patients	24 operations

In every case there was cavernous apical disease on one side. Pneumothorax or oleothorax had been instituted previously on the other side in 9 cases, and thoracoplasty (1st to 7th ribs) done in one case. In the eleventh case extrapleural pneumolysis was done later on the other side. I thought it was best to put the latter case in this group.

The following rib resections were done together with apico-lysis in the bilateral cases

1st stage — ribs	1—3	1—3	1—4	1—4	1—4	1—4	1—3	1—3
2nd stage — ribs		4—6		5—6	5—7	5—8	4—6	4—6
3rd stage — ribs							Re-thor-	7—8
4th stage — ribs							acoplasty	1—4
								anteriorly
No of cases	1	4	1	1	1	1	1	1

The complications and results will be discussed later

### III. Tuberculous Empyema. 17 Cases.

The cases were equally divided between the sexes and sides  
The origins of the empyema were

spontaneous pneumothorax	1
artificial pneumothorax, later infected	5
pneumothorax, later oleothorax, infected	4
pneumothorax with cauterization (paraffin pack used later in one case)	7

There were 8 cases of total and 9 of more partial empyema  
Eleven cases had been drained and had long-standing fistulas  
Six patients had closed empyema, but a few of them had a bronchial fistula for they coughed up pleural contents

The operations performed were as follows

*Thoracoplasty in 1 stage* three times One patient died after the operation In this case the first to sixth ribs were resected over a partial, closed empyema in the upper part of the lung, but there was a bronchial fistula through which the pleural exudate was coughed up Atelectasis occurred on the operated side, bilateral bronchopneumonia developed and the patient died nine days after the operation In another case of fistulous total empyema in a very ill patient otherwise, the first to sixth ribs were resected in one sitting Aspiration with bronchopneumonia occurred on the other side The sputum was without tubercle bacilli The patient remained ill and feverish, he acquired spondylitis and epididymitis and died a year and a half after the operation from tuberculous meningitis In a third case of spontaneous tuberculous pyopneumothorax the second to eleventh ribs were resected after drainage, with restoration of health and



a dry fistula as the result. The patient has now been working full time at farming and building for five years.

*Thoracoplasty in 2 stages* was done in 6 cases. In 4 cases of partial empyema eight or nine ribs were resected in each case (with apicolysis in two cases) and in 2 cases with total empyema the first to eleventh ribs. Five of the 6 patients are now well with no expectoration and negative sputum, and the fistula is closed in three cases. One patient with a closed pneumo-oleo-thorax and much expectoration (bronchial fistula) did not get better and remained feeble, and after he was transferred to a sanatorium pyopneumothorax again developed. He came back again in poor condition, surgical drainage was done but he did not get well and died one year after the last operation from tuberculous peritonitis and amyloid degeneration.

*Thoracoplasty in 3 stages* was done in 4 cases. In two fistulous cases, total thoracoplasty was done with resection of the first to eleventh ribs and apicolysis. Both patients grew well with a closed fistula and no expectoration. They are now doing full work two and four years, respectively, after the last operation. In a third case there was a large suspended cavity in the left lung apex, while below was a large pneumo-oleo-pyothorax. The latter was punctured and drained and was relatively improved and closed before the operation. Thoracoplasty with apicolysis was carried out with resection of the first to eight ribs and the first to third anteriorly. The patient then grew well without expectoration or bacilli and is now doing full farming work three and a half years after the last operation. In the fourth case of a 17 year old girl fistulous secretion persisted after total thoracoplasty for fistulous total empyema, pleurectomy was performed. She then improved, the secretion ceased after three months, and she has later been well for a year.

*Thoracoplasty in 4 or 5 stages* was done in 4 cases. The cases were mostly ones of severely ill patients with greatly infected total empyema in which the ribs were resected posteriorly in three stages, and resected anteriorly together with cartilage in another stage. In addition another rib resection with pleurectomy was done in three cases, the whole lateral wall of the residual cavity being radically excised. In two cases phrenicectomy was also done.

These extensive operations took a long time, sometimes several years. In one severe case with five operations, including pleu-

rectomy, the patient became entirely cured with a closed fistula and has now been fully capable of work for a year and a half since the last operation. One patient has just undergone his fifth plastic operation with pleurectomy, is in good general condition and seems to be on the way to recovery. One patient had persisting fistulous secretion from a small residual pleural cavity but suffered from severe amyloid nephritis and refused to undergo another operation. He died three years after the first operation and one year after the last of amyloid degeneration. One patient underwent altogether seven operations, including one rib resection for drainage and epididymectomy, but died of amyloid degeneration nearly three years after the first operation and four months after the last.

Time-consuming treatment of this kind requires great patience on the part of both the patient and surgeon but can lead to full recovery, even though there may be many disappointments. The end results will be discussed later.

### Complications.

The immediate complications in the three groups are seen from table 1.

The two cases of death after operation for unilateral apical involvement were as follows:

*Case 1* A man, aged 26, had tuberculosis in the left lung for three years. Artificial pneumothorax was instituted. Because of poor collapse and adhesions, the apex was loosened with the cautery later, and he was then given ambulant pneumothorax treatment. Later on an exudate was drained off and replaced by air. Positive pressure developed constantly and the pleural cavity over the apex, where there was a residual cavity, shrank. It was planned, therefore, to remove six ribs. Single stage thoracoplasty and apicolysis was done under local anesthesia, the first to fourth ribs being resected. After the operation increasing dyspnea and cyanosis developed and the temperature rose. Roentgenograms five days after the operation showed total atelectasis in the operated lung and dense shadows of infiltration in the other. He was given oxygen and had received sulfathiazole the whole time but he died seven days after operation.

The patient was big and fat, and the operation difficult and prolonged. He had also had a cold and coughed about two weeks before the operation, but was thought to be well. Perhaps this previous, ordinary infection in the respiratory passages had something to do with the fatal complication.

Table 1.

*The Immediate Complications in the Three Groups of Cases*

	After	Dead	Shock — blood transfusion Hemorrhage	Atelectasis on operated side	Aspiration to the other lung	Slight pleural exudate on operated side	Thrombosis in vena axillaris	Thrombosis in femoral vein	Thrombosis and wound infection	Spontaneous pressure puen mothorax on other side
<i>I Unilateral disease</i> 81 cases, 142 operations	1st stage 2nd stage	1 1	1 4	8 1	2 3	5 3	1 3	3 1	5 1	
<i>II Bilateral disease</i> 11 cases, 25 operations	1st stage 2nd stage	1 1	1 3	3 3	1 1				1 2	1 1
<i>I + II</i> 92 cases, 167 operations		3	2	18	4	8	1	3	1	8
<i>III Tuberculous em- pyema</i> 17 cases, 46 operations		1		5	1	1			1	
Total — 109 cases, 213 operations		4	2	23	5	9	1	3	1	9

*Case 2* A woman of 36 had pulmonary tuberculosis with an apical cavity on the left side for three years. The temperature was slightly uneven, the sedimentation rate 86 mm in one hour. It was planned to resect seven ribs. Thoracoplasty with resection of the first to fourth ribs and apicolysis was done under local anesthesia. The postoperative reaction was fairly intense, the temperature rising to 39 C the second day. Blood was transfused. The temperature then fell steadily but slowly, staying around 38 C for three weeks. Roentgenograms showed spreading with spotted bronchopneumonic foci in the right lung. The condition improved gradually.

The next operation was delayed for eight months. The fifth to seventh ribs were then resected under local anesthesia. The second day after the operation the temperature rose again and tough, mucoid, purulent sputum was noted. Blood transfusion caused no particular improvement. On the third day dyspnea set in, the healthy, right side of the thorax moved only slightly and marked diaphragmatic respiration was observed. She coughed with great difficulty. Roentgeno-

grams showed distinct infiltration in the middle and especially the lower part of the right lung. Oxygen and blood transfusions helped only temporarily and she died six days after the operation.

Thus atelectasis with retention of secretion and bronchopneumonia occurred again in the usual way. Perhaps the infiltration after the first operation was re-activated by the second one. The case of postoperative death in a bilaterally treated patient was the following:

*Case 3* A man, aged 28, had bilateral pulmonary tuberculosis for about two years. He had a pneumothorax on the right side and an apical cavity on the left. There was a moderate amount of sputum and a tendency to hemoptysis. He was hospitalized Aug 3, 1939 for operation, but the day after he had hemoptysis and was sent back to the sanatorium. Two weeks later, when it was thought that his condition allowed it, he was again referred for operation. However, slight exudate had developed in the pneumothorax cavity on the right side.

Left-sided thoracoplasty with the resection of five or six ribs in two stages was planned. On August 22 resection of the first to third ribs and apicolysis were done under local anesthesia. The same evening the patient suddenly became ill with signs of shock and a small, rapid and soft pulse, but no dyspnea or cyanosis. Blood transfusion had a relatively good effect. He complained of pressure anteriorly in the chest. The wound cavity was punctured but no rise in pressure was seen there. Oxygen was given. The next day he was better but pale and perspiring and rattling sounds were audible in the chest. In the evening the temperature rose to 39 C. He remained ill throughout the night and died August 24, two days after operation. She died of bronchopneumonia nine days after operation. This case is spoken of on page 413.

These cases of death after thoracoplasty are highly characteristic and I have reasoned that they occurred in the following way. Immediately after the operation changes occur in the circulation and particularly the respiration due to the shock and mechanical changes in the thoracic cavity. Reduced costal respiration, paradoxical movements of the thorax and increased diaphragmatic respiration characterize the condition. There immediately develops a more copious bronchial secretion of which the patient has a relatively little sensation. As a rule he coughs up some secretion the day of operation and particularly the following day, and the situation becomes adjusted. But if the secretion is greater than usual and the coughing is not effective, the re-fluid is retained. Atelectasis develops and when infection inter-

venes mucopurulent bronchitis or bronchopneumonia sets in and ends the patient's life, generally within a week. Cases 1, 3 and 4 are examples of this.

In milder cases, aspiration and spreading of infection occurs, mostly to the other lung, with disseminated, relatively small bronchopneumonic foci which in all cases may be assumed to be nonspecific to begin with. The condition is manifested by slight dyspnea, often in attacks, sometimes cyanosis, and a protracted rise in temperature which may persist several weeks. The course after the first operation in case 2 is an example. Most patients recover, but roentgenograms show remains after the infiltration long afterwards.

I have performed autopsy in several cases of the first type, and made almost always the same observations. The bronchi and part of the trachea are filled with slimy, purulent secretion. In the cases where death occurs within the first week the secondary changes in the lungs are inconspicuous. When the course is drawn out longer, secondary bronchopneumonia develops. Thus there is mucopurulent bronchitis, and sometimes bronchopneumonia, with direct suffocation in the secretion.

It is not possible to say in advance what patients are likely to have this complication. My experience is that persons with the corpulent, thick-set pyknic physique have a greater tendency than others. In one of my cases there was an acute upper respiratory infection shortly before, in another hemoptysis and in the third an uneven temperature and elevated sedimentation rate, each of these conditions indicating something out of the ordinary. Operation in small, cautious stages alone does not seem to guard against fatal complications. I believe that the choice of the cases and the time of operation are the most important factors on which the surgeon has any influence, if the method and technique of operation are careful otherwise. Entire avoiding of deaths after these operations on the thorax and lungs can hardly be expected.

Much can be done therapeutically when the condition is threatening. The most effective measure is direct aspiration of mucus and pus from the trachea, as recommended by some authorities. Personally I have systematically attempted to combat the development of the condition with the following measures. Careful bandaging is done to support the thorax and make the respiration and coughing effective. As the bandage often slips, rebandaging often gives relief. The patient is kept in a comfortable

sitting position. Blood is transfused on signs of shock. A specially trained nurse encourages and helps the patient to cough properly. Moderate doses of morphine are given at the right time. Stimulants of the cardiazol type are used to alleviate the respiration and coughing. Sulfanilamide drugs are given during the first pre-operative period to combat secondary infection. Food is soon given and the bowel movements are carefully supervised. Oxygen is administered continuously as soon as signs of dyspnea or cyanosis appear. By these means I feel I have warded off many complications in their inception.

As regards the other complications, the following may be noted.

*Hemorrhage* occurred twice during the operation, once from an artery under the brachial plexus and the other time from a small lesion in the subclavian vein. Neither hemorrhage hindered the completion of the operation or caused any delay in recovery. In one case a slight blood-tinged secretion was discharged from the wound for a short time. In the first case slight thrombosis developed in the axillary vein.

*Shock* Really serious postoperative shock with a small, soft pulse and cold, clammy and perspiring skin seldom occurred but milder forms were seen in a few cases. Blood transfusion, the sovereign method of treatment, was given 23 times after altogether 213 operations, mostly after first-stage operations.

*Atelectasis* clearly visible in roentgenograms of the operated lung was observed 5 times, 4 times after a first-stage operation. In two of the latter cases the patient died.

One of the surviving patients had a cavity in the left apex and an old infiltration in the lower part of the same lung. This process was deemed to be stable and without risk, and an apical thoracoplasty was planned. A very cautious operation with resection of the three upper ribs together with apicolysis was performed. Then atelectasis in the lower part of the operated lung occurred. The atelectasis cleared up, but the old basal process was re-activated and cavities developed. The case is at present not fitted for further operative treatment.

In another case at an earlier occasion a thoracoplasty with partial resection of the first to seventh ribs without apicolysis had been performed together with phrenicocoxaeresis on the right side. We were not aware of a rest cavity persisting in the apex. Later on the patient got a cavernous tuberculosis in the left apex, and a partial thoracoplasty with resection of the three upper ribs

and apicolysis was performed as a first-stage operation. Then atelectasis on the last operated left lung occurred, the condition of the patient was bad, but he recovered quickly after having coughed up pure pus. The atelectasis cleared up, and the planned thoracoplasty was later completed with two new operations which he stood well. At examination three years later the diseased part of the left lung is well collapsed, but the rest cavity in the right apex persists, and he occasionally has a little expectoration with tubercle bacilli. He is able to do some work as a fisher. I have proposed for him to do a new plastic operation with apicolysis on the right apex, but he hitherto has denied it. — This case only confirms the old experience that bilateral thoracoplasty is a very risky treatment of pulmonary tuberculosis. The atelectasis in the fifth case seems to have completely disappeared.

*Aspiration* with dissemination of bronchopneumonic foci in the other lung occurred after 8 operations (seven patients), 5 times after a first-stage operation and 3 times after a second stage. The infiltration cleared up after a reasonable time in the five first cases and the first-stage operation proved to be sufficient in four of them, the patient becoming well afterwards. In the fifth case the operation was continued with a second stage eight months later, but the infiltration in the healthy lung was re-activated and the patient died (case 2). One of the two other patients with this complication after the second stage became well and the other was subjected to a third-stage operation with a good result. Thus one of the 7 patients died and the others made a complete recovery.

*Thrombosis* in the axillary vein on the operated side occurred to a mild degree three times and disappeared rapidly each time. The second stage of the operation was done at the ordinary time and the thrombosis had no later sequels. In one man aged 21 thrombosis developed in the left lower leg after a first-stage operation. The second stage was done six months later with no complications.

A serious complication occurred after a second-stage operation with resection of the fourth to sixth ribs in a patient who had a pneumothorax on the other side. Five days after the operation severe dyspnea suddenly set in and the patient looked almost moribund. *Positive pressure pneumothorax on the nonoperated side* was discovered in the artificial pneumothorax instituted earlier. Aspiration was kept up continuously for two days and oxygen

was given. The situation looked precarious but the valve seemed to close again gradually and after two days the patient began to improve rapidly. Unfortunately this patient, on whom we spent the greatest amount of effort, died a year later of epidemic cerebrospinal meningitis. He was then cured of tuberculosis<sup>1</sup>.

*Infection of the wound* occurred altogether 9 times, 7 times after a first-stage operation and 2 times after a second stage. Five of the wounds had been closed immediately and 4 drained for one day. In four of the cases it seemed to be a question of infected hematoma, first bloody and then yellowish fluid being discharged from the wound for a short time. In the other instances it was more a question of primary infection with staphylococci in the wound cavity, which had to be drained. In two of the cases one or two of the underlying ribs were resected to improve the drainage, and cause greater collapse of the wound cavity and lung. In all except one instance the discharge rapidly decreased and the wound dried up fairly quickly. In the cases where a second-stage operation had to be done, it was carried out two to eight months later without complications and with a good result. In one case staphylococcic infection occurred immediately, but the secretion persisted and later tuberculous infection developed in the wound cavity. The cavity was again operatively revised and the clavicle resected to produce better collapse. Three months later the wound was closed, and the patient has later for soon a year been cured. Thus, in 8 of the 9 cases of mild or severe non-tuberculous infection of the wound and wound cavity, healing took place relatively quickly and the infection did not make any change in the operations planned. One case of tuberculous infection was also cured.

Powerful collapse and shrinkage often occurs in these cases of healed infection in the wound cavity, and the end results are generally excellent. My cases were examples of this. Seven patients are quite healthy. One has one year ago undergone a third-stage operation and is free of bacilli and relatively well at present. In one case there is perhaps a small residual cavity and the sputum is occasionally positive (originally a giant cavity, half the lung). The patient has been given roentgen treatment but without sure effect. Thus 8 of the 9 cases have been free of bacilli for a long time. The wound cavity is healed in all cases.

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<sup>1</sup> In the series he is reckoned as living and cured.



I have noted the following regarding the occurrence of these infections. Five of the nine infections in the wound occurred in the first twenty-six cases I operated on during my first four and a half months at a new hospital. Earlier, in another hospital, I had operated on twenty-five patients, also within the course of four months, without any infection occurring. I took all the precautions imaginable but did not get rid of infection until I had a mask put on all the persons present in the operating room. Then the infections practically stopped. The other four infections, of which one was fairly mild with slight oozing of bloody fluid from the wound a few weeks, occurred in the following four and a half years in the remaining two-thirds of the series. More than two years passed without a single infection.

I cannot produce any proof, but I have a strong impression that air-borne infection, probably from the air expired by the persons present, plays a large part. All the infections occurred in the fall and winter months when the possibility of the staff having respiratory infections must be considered. Otherwise I cannot think of any other measures apart from the ones I have already mentioned when discussing the operative technic and after treatment. Perhaps radiation of the wound region with ultra-violet light may be further insurance against infection, but I lack experience in this regard.

That the organism is highly resistant against tuberculous infection is evident from the fact that one often removes or injures glands when performing apicolysis posteriorly which on microscopic examination prove to be tuberculous. Once when I was loosening the lung apex from the mediastinum medially I exposed a caseous mass in an opened gland without any infection following. It is true that I tried to cover it by sewing it over but the blocking was only illusory. On the other hand, tuberculous infection may also occur late in a wound which first seems to be sterile.

The observation is also verified that patients with a pneumothorax on one side tolerate thoracoplasty on the other side surprisingly well, — one is tempted to say better than the unilateral cases. In 11 bilaterally treated cases I had only one lung complication. Atelectasis developed in the contralateral lung, but then it was not pneumothorax which had been effected previously but thoracoplasty and exaeresis. This is also an old experience, that bilateral thoracoplasty is a dangerous combination.

# Results.

The end results are seen from table 2.

Table 2.  
*The End Results in the Whole Series of 109 Cases.*

	I Unilateral Operation in		II Bilat- eral	III Tuber- em- pyema	Total	% of total	% of sur- viv- ors	% of ope- ra- tions
	1 stage	2 stages						
No. of patients . . . . .	25	56	11	17	109			
No. of operations . . . . .	25	117	25	46	213			
Died < 2 mos. after op. . .	1	1	1	1	4	3.7	9.2	1.9
Died of tuber. > 2 mos. after op. . . . .	1	1	—	4	6	5.5		
Surviving . . . . .	23	54	10	12	99	91		
Cavity collapsed, roentgen.	22	53	7	12	94	86	94	
Tb. — . . . . .	22	53	7	12	94	86		
Capable of work . . . . .	19	48	5	9	81	75	82	

## Years of Observation<sup>1</sup>

	1	1—2	2—3	3—4	4—5	Total
Cured, tb. — . . . . .	12	19	16	16	29	94 (94%)
Empyema, persisting fis- tula, tb. — . . . . .	1	1				
Tb. + . . . . .	1	2	1	1		
	14	22	17	17	29	99

Four patients, or 3.7 per cent of the 109 cases of cavernous pulmonary tuberculosis, 17 of which had tuberculous empyema (11 with fistulas), died soon after the operation. Later 6 more patients, or 5.5 per cent, died of tuberculosis, making altogether 10 deaths. i. e. 9.2 per cent.

<sup>1</sup> One year has gone since the manuscript was finished and sent in November 1943. The time of observation therefor can be augmented with one year all over and is then from 1½—6 years. No alteration of importance regarding the end results has occurred during that time.

Ninetynine patients, or 91 per cent survive. Of these, 91 per cent are clinically cured with roentgenographically demonstrable collapse of the cavity and have been free from tubercle bacilli during an observation period of up to five years. The length of the observation periods is seen from the following.

Of the survivors, 82 per cent are capable of work, and 70 per cent have entirely resumed their former occupation, generally farming and fishing in the case of the men.

As regards the 17 cases of empyema, in particular, the results are as follows. One patient died shortly after the operation. Four died later, the first with a persisting fistula four months after the operation from amyloid nephritis, the second with persistent infection and pyopneumothorax one year after the last operation from tuberculous peritonitis and amyloid degeneration, the third with persisting infection three and a half years after the last operation from spondylitis, epididymitis and tuberculous meningitis and the fourth one year after the last operation with persistent secretion and amyloid degeneration. The end results are summarized in table 3.

Table 3

*The End Results in the 17 Cases of Tuberculous Empyema, 9 Men and 8 Women, 46 Thoracoplastic Operations, 5 with Apicolysis, 3 Pleurectomies*

	No	Died immediately	Died later	Cured	Improved	Fistula closed	Sputum Tb +	Sputum Tb -	Doing full work
Fistulous Closed	11		3	6	2 <sup>1</sup>	6		11	6
	6	1	1	4			2 (died)	1 (3 died later)	3
	17	1	4	10	2	6	2 (died)	15 (3 died later)	9

A definite cure was noted in 10 cases, 6 of which had fistulas. Eight have been doing full work, most of them for a long time, one for five years at farming and building. Two have been well for half a year but have not yet begun to work. In 6 of the fistulous cases the fistula closed. Two have recently undergone

<sup>1</sup> Two have newly undergone pleurectomy, seem to be on the way to recovery.

pleurectomy and judging by the course hitherto have good hopes of a cure. The great majority of the patients have been rid of their expectoration. As regards tubercle bacilli, the patient who died after the operation may be excepted. Of the others one patient had positive sputum when he died a year after the operation, all the others, i. e. all 12 survivors, have negative sputum.

### Summary.

A report is made of 109 cases of pulmonary tuberculosis in which the author performed thoracoplasty and the results after an observation period of up to six years. 1) In 81 cases there was unilateral cavernous tuberculosis in the upper part of the lung. 2) In 11 cases the disease was bilateral. Pneumothorax or oleothorax, pneumolysis or thoracoplasty were done on one side, and cavernous apical infection existed on the other. 3) In 17 cases there was tuberculous empyema, generally secondary to pneumothorax.

As a rule partial thoracoplasty with apicolysis according to the principles and technic of HOLST and SEMB was performed under local anesthesia. Apical thoracoplasty with resection of four or five ribs was done in one sitting. Otherwise the operation was generally divided into stages with resection of three or four ribs in the first. The main type of operation consisted of thoracoplasty with the resection of six or seven ribs in two stages. In the cases of empyema, thoracoplasty with or without apicolysis was done. If the fistula persisted, pleurectomy was done together with radical excision of the outer wall of the empyema cavity. Altogether 213 operations were done on the 109 patients.

Four patients, or 3.7 per cent died after the operation. Six or 5.5 per cent, died later, 4 months to a year and a half, from tuberculosis. Altogether 10 or 9.2 per cent, died. Ninetyfour, or 94 per cent, of the 99 survivors are clinically cured of their pulmonary tuberculosis, roentgenograms showing collapse of the cavity and the patient being free of tubercle bacilli. The great majority have no expectoration. Two of the patients with empyema still have remainders of a fistula, but they are improving. Five per cent have still bacilli in the sputum. Eightytwo per cent of the survivors (75 per cent of the whole series) are capable of work and 70 per cent are doing full work in their former occupations,

generally farming and fishing. The period of observation was less than one year in 14 of the 99 surviving cases, 1 to 2 years in 22, 2 to 3 in 17, 3 to 4 in 17 and 4 to 5 in 29 (5 whole years in 6 cases)<sup>1</sup>

As regards the 17 cases of tuberculous empyema, 11 had fistulas and 6 were closed. Several of the latter had a bronchial fistula. One patient died after the operation, and 4 later from tuberculosis. Ten are definitely cured. In six of the fistulous cases the fistulas are closed. Two are undergoing treatment and seem to be getting well. All twelve survivors are free of bacilli. Nine have been doing full work, most of them for a long time, one for five years.

It seems difficult entirely to avoid fatalities after these operations. Apart from a painstaking method and technic of operation, careful selection of the cases and of the opportune time for operation seems to be of the greatest importance.

### Zusammenfassung.

Verf. berichtet über 109 Fälle von Lungentuberkulose, an denen er die Thorakoplastik vorgenommen hatte, und über die Ergebnisse derselben bei einer Beobachtungszeit von bis 6 Jahren. 1) In 81 Fällen lag *einseitige* kavernöse Tuberkulose der oberen Partie der Lunge vor. 2) In 11 Fällen war die Erkrankung *doppelseitig*, indem auf der einen Seite ein Pneumothorax oder Oleothorax, eine extrapleurale Pneumolyse oder Thorakoplastik vorlag, und auf der anderen Seite eine kavernöse Spitzenaffektion. 3) In 17 Fällen war ein *tuberkuloses Empyem* vorhanden, oft sekundär zu einem Pneumothorax. — Es wurde in örtlicher Betäubung gewöhnlich eine partielle Thorakoplastik mit Apikolyse nach den Prinzipien und der Technik von HOLST und SEMB vorgenommen. Eine 4—5 Rippen umfassende Spitzenplastik wurde einseitig gemacht, sonst operierte man grundsätzlich mehrseitig mit Abtragung von 3—4 Rippen in der ersten Sitzung. Der Haupttypus war eine zweizeitige Thorakoplastik von 6—7 Rippen. Bei Empyem wurde eine Thorakoplastik mit oder ohne Apikolyse gemacht. Falls die Fistel fortbestand, wurde zusätzlich eine Pleurektomie, d. h. radikale Abtragung der äusseren Wand der Empyemhöhle,

<sup>1</sup> One year can now be added to the time of observation. No alteration in the end results has occurred.

vorgenommen. So wurden an den 109 Kranken im ganzen 213 Operationen vorgenommen.

4 sind im Anschluss an die Operation gestorben, das macht 3,7 % aus 6 sind später (nach 4 Monaten bis 1½ Jahren) an tuberkulöser Erkrankung gestorben, das sind 5,5 %. Im ganzen sind 10 Kranke, d. h. 9,2 %, gestorben 99 überlebten. Von diesen sind 94, d. h. 94 %, *klmisch geheilt* von ihrer Lungentuberkulose, indem röntgenologisch Kavernenkollass vorliegt und die Kranken bazillenfrei sind, die Mehrzahl im grossen ganzen frei von Auswurf. Bei 2 Kranken mit Empyem bestehen jedoch noch Reste einer Fistel fort, doch stehen sie jetzt unter abschliessender Behandlung hierfür 5 % haben nach wie vor Bazillen im Auswurf 82 % *der Überlebenden* (75 % sämtlicher) *sind arbeitsfähig*, und 70 % sind in voller, gewöhnlicher Arbeit, was in unserer Gegend zumeist Landarbeit und Fischfang bedeutet. Die Beobachtungszeit bei den 99 Überlebenden betrug für 14 Kranke < 1 Jahr, für 22 Kranke 1—2 Jahre, für 17 Kranke 2—3 Jahre, für 17 3—4 Jahre und für 29 4—5 Jahre (in 6 Fällen volle 5 Jahre) <sup>1</sup>

Was die 17 tuberkulösen Empyeme im besonderen anbelangt, so waren 11 fistelnd und 6 geschlossen, mehrere mit sicherer Bronchialfistel 1 starb im Anschluss an die Operation und weitere 4 später an ihrer tuberkulösen Erkrankung 10 sind endgültig geheilt, 6 der fistelnden Empyemhöhlen und Fisteln sind geschlossen, 2 stehen in Behandlung und scheinen günstig zu verlaufen. Sämtliche 12 Überlebende sind bazillenfrei 9 sind in voller Arbeit, die Mehrzahl seit längerer Zeit, einer seit 5 Jahren.

Todesfälle nach diesen Operationen völlig zu vermeiden, dürfte schwer sein. Neben vorsichtiger Operationsmethode und Technik scheinen eine sorgfältige Auswahl der Fälle und ein günstiger Zeitpunkt für die Operation von grösster Bedeutung zu sein.

### Résumé.

Relation de 109 cas de tuberculose pulmonaire où l'auteur a exécuté une thoracoplastie, et communication des résultats après une période d'observation allant jusqu'à six ans.

1 Dans 81 cas il y avait une tuberculose cavitaires unilatérale de la partie supérieure du poulmon.

<sup>1</sup> Die Beobachtungszeit ist jetzt um ein Jahr länger geworden. Keine Veränderungen der Ergebnisse sind eingetreten.

2 Dans 11 cas la maladie était bilatérale. On recourut au traitement par pneumothorax ou oléothorax, pneumolyse ou thoracoplastie d'un côté, tandis qu'une infection apicale avec caverne existait de l'autre.

3 Dans 17 cas il y avait un empyème tuberculeux, généralement secondaire à un pneumothorax.

Dans la règle on pratique, sous anesthésie locale, une thoracoplastie partielle avec apicolyse selon les principes et la technique de HOLST et SEMB. La thoracoplastie apicale avec résection de quatre ou cinq côtes avait lieu en un temps. Par ailleurs l'opération était généralement scindée en plusieurs temps avec résection de trois ou quatre côtes dans le premier. Le type principal de l'intervention était celui de la thoracoplastie avec résection de six ou sept côtes en deux temps. En cas d'empyème, c'est la thoracoplastie avec ou sans apicolyse qui fut choisie. Devant une fistule persistante, on s'adressa à la pleurectomie associée à l'excision radicale de la paroi externe de la cavité empyémateuse. En tout on exécuta 213 opérations sur les 109 malades.

Quatre patients, soit 3,7 % du total, moururent après l'opération. Six, soit 5,5 %, décédèrent plus tard, dans des délais de quatre mois à un an et demi, de tuberculose. En tout il y eut 10 décès, ce qui fait une mortalité de 9,2 %. Quatre-vingt-quatorze des 99 survivants, donc 94 %, sont guéris cliniquement de leur tuberculose pulmonaire, les radiographies montrant un collapsus de la cavité et le sujet étant débarrassé de ses bacilles de Koch. La grande majorité n'ont plus d'expectoration digne de mention. Deux des malades avec empyème ont des restes de fistule. Cinq pour cent ont encore des bacilles dans leurs crachats.

Quatre-vingts-deux pour cent des survivants (75 % de toute la série) sont capables de travailler et 70 % ont leur capacité totale dans leurs occupations antérieures, en général la culture de la terre et la pêche. La durée d'observation a été de moins d'une année pour 14 des 99 survivants, d'un à deux ans pour 22, de 2 à 3 ans pour 17, de 3 à 4 ans pour 17, et de 4 à 5 ans pour 29 (de cinq années entières pour six cas)<sup>1</sup>.

En ce qui concerne les 17 cas d'empyème tuberculeux, 11 avaient des fistules et 6 étaient fermés. Plusieurs de ces derniers avaient une fistule bronchique. L'un des malades mourut après l'opération, et quatre autres plus tard, de tuberculose. Dix sont définitivement

<sup>1</sup> Maintenant encore un an est écoulé. Les résultats sont les mêmes.

guéris Dans six des cas fistulisés les fistules sont fermées Deux sont encore en traitement et paraissent en bonne voie Tous les douze survivants sont indemnes de bacilles Neuf ont repris leur travail à cent pour cent, la majorité d'entre eux depuis longtemps, l'un depuis six ans

Il semble difficile d'éviter complètement des échecs mortels après ces opérations. A côté d'une méthode et d'une technique opératoire méticuleuses, c'est la sélection soigneuse des cas et le choix du moment favorable à l'intervention qui paraissent avoir la plus grande importance

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# Zur Behandlung veralteter Schenkelhalsbrüche mit Knochenverpflanzung.

Von

a o Prof Dr med A J PALMÉN,  
Helsinki

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Obgleich die Nagelung von frischen Brüchen des Schenkelhalses sich als Normalverfahren bewahrt hat und dadurch meistens gute Heilung erzielt wird, kommen noch immerhin vernachlässigte Brüche bzw falsche Gelenke am Schenkelhalse vor. Es handelt sich um indolente Leute, die nicht rechtzeitig Hilfe suchen, um diagnostische oder technische Fehler oder sogar um mangelhafte Neigung zur Konsolidation, solche veraltete Fälle kommen dann und wann zur Behandlung, wenigstens zwecks Verminderung hochgradiger Invalidität.

Die Behandlung veralteter Fälle bildet ein noch schwereres Problem als die der frischen. Es wird noch oft die Resektion des Hüftgelenks und Anstreben von Versteifung in gunstiger, d h abduzierter, Stellung empfohlen. Auch wird wohl die verspätete Nagelung zuweilen versucht. Nach diesen Massnahmen sind wirkliche Heilung und gute Leistungsfähigkeit selten. Durchbohrungen oder Fragmentation sollen noch weniger leisten. Wegen schlechter Erfolge mit diesen Verfahren habe ich in einigen Fällen versucht, die Fragmente mit einem frischen Knochenspan zu vereinigen. Der Gedanke der autoplastischen Knochenverpflanzung zu diesem Zweck ist nicht neu, aber die Anregung zu deren technischer Ausführung hat die entsprechende Nagelungsoperation gegeben.

Die Technik der Operation ist folgende. Ein etwa 10 cm langer Knochenspan wird aus der Kortikalis am obersten Teil des Femur

schaftes losgemacht. Der Span ist 8—12 mm breit, periostbekleidet, und umfasst die ganze Dicke der Kortikalis. Wenn möglich nach Wiederherstellung der natürlichen Stellung wird dieser Span als Nagel in den Schenkelhals eingetrieben. Dabei wird der oberste Teil der Entnahmestelle als Eintrittspforte angewendet, Aufbohrung des Kanals ist nicht nötig. Die Richtung muss durch Freilegen des Halses oder in der üblichen Weise mit Leitbohrung und Röntgenstrahlen gefunden werden.

Ich erlaube mir, folgende Fälle hier zu beschreiben.

1. Ein 50-jähriger Mann wurde vor 8 Monaten von einem Kraftwagen überfahren und bekam u. a. einen Schenkelhalsbruch. Behandlung mit Zugverband und Gips gab keine Heilung. Bei der Krankenhausaufnahme Verkürzung  $2\frac{1}{2}$  cm, massige Adduktionkontraktur, Gehen nur mit Krücken. Im Röntgenbild keine knöcherne Heilung, schlechte Stellung mit  $\frac{1}{2}$  cm Diastase oben, Kontakt der Fragmente unten. *Operation*: Reposition nicht möglich, aber Korrektur der Kontraktur in Narkose möglich. Von einem äusseren Schnitt her wird der Oberschenkelknochen freigelegt, aus der Kortikalis von der Wurzel des Trochanter major an nach abwärts wird ein 1 cm breiter Knochen-span mit dem Meissel abgelöst. Die Vorderfläche des Schenkelhalses lässt sich leicht bis zur Stelle der Pseudarthrose entblößen. Der Span wird durch den obersten Teil der Entnahmestelle mit dem Hammer in den Schenkelhals hineingetrieben. Die Richtung wird durch die Sichtbarkeit der Bruchstelle erleichtert. Der Knochen ist ziemlich atrophisch und macht keinen grossen Widerstand. Der Span sitzt nachher ziemlich fest. Eingipsung in Abduktionsstellung. *Verlauf*: Gute Wundheilung. Aufstehen nach 3 Monaten. Im Röntgenbilde deutliche überbrückende Kallusbildung, Stellung der Fragmente im grossen ganzen unverändert. Briefliche Mitteilung 7 Monate nach der Operation, dass der Patient mit Stütze eines kleinen Stockes bis 3 Kilometer auf der Landstrasse gehen kann.

2. Etwa 65-jährige Frau von 90 Kilo Gewicht, im Zimmer auf die Hüfte gefallen. Freie mediale Kollumfraktur. Einige Tage nach dem Unfall in meine Behandlung. Nagelung nach JOHANSSON. Gute Stellung, zuerst scheinbare Heilung, Aufstehen nach 2 Monaten, gute Beweglichkeit, aber nicht völlige Stützfähigkeit. Etwa ein halbes Jahr nach dem Unfall beim Gehen Bruchrezidiv. Die Röntgenuntersuchung zeigt einen Bruch an derselben Stelle, der Nagel ist in einer Länge von 3 cm abgerutscht und reicht eben bis an die Bruchlinie. *Operation*: In Lumbalanästhesie lässt sich der Bruch gut reponieren. Der Nagel kann mit blossen Fingern ausgezogen werden, dabei fliesst eine kleine Menge seröser Flüssigkeit heraus. Ein 10 cm langer Knochen-span von 12 mm Breite wird aus der Kortikalis angefertigt und in das Nagelloch hineingetrieben. Fester Widerstand in 9 cm Tiefe. Röntgen zeigt gute Stellung und Fixation. Keine Schiene, nur Bettlage. Heilung der Wunde ohne Reaktion. Nach 5 und 8 Monaten im Röntgenbild gute Kallusbildung, wobei der knöcherne Nagel noch ganz deutlich sichtbar

ist Die Patientin geht damals noch sehr vorsichtig, kann aber das ganze Körpergewicht auf das verletzte Bein stützen

3 Etwa 60-jährige Frau, schwach und mager Unfall durch Fallen auf die Knie, wegen Angst vor Operation zwei Monate lang zu Hause zugewartet Medialer, freier Schenkelhalsbruch, zarter Knochenbau *Operation* Die Bruchteile lassen sich in Lumbalanästhesie auf dem Extensionstische in gute Stellung bringen Die Femurkortikalis hat eine Dicke von nur 3 mm Es wird ein 8 cm langer Knochenspan abgelöst und zugleich mit einem Stahl Nagel in den Schenkelhals eingehämmert Dabei liegt der Span in einer Rinne des Nagels und folgt diesen Verlauf. Gute Heilung Aufstehen nach einem Monat Nachuntersuchung 2 Jahre später zeigt ebenso gutes Stützen auf beiden Seiten

Die oben beschriebenen Versuche haben mir den Eindruck gegeben, dass auch veraltete Brüche des Schenkelhalses mit positivem Erfolg operativ behandelt werden können und zwar durch Überbrückung der Bruchlinie mit autoplastischem Knochen Dieses muss am leichtesten durch Knochenbohrung mit einem genügend langen Knochenspan in einer der Kollumnagelung entsprechenden Weise ausführbar sein Dabei ist der äußere, oberste Teil des Femurschaftes als Entnahmestelle des Spanes besonders vorteilhaft Die Kortikalis ist hier genügend dick, die Achse des Kollum wird zugänglich und die Öffnung hat dasselbe Kaliber wie der knocherne Nagel Auch muss diese Gegend sowieso lange immobilisiert oder sonst vorsichtig behandelt werden, und eine Schwächung irgend eines anderen Knochens wird vermieden

Es ist vorläufig wahrscheinlich, dass lebensfähiges Knochengewebe besser einheilt und auch besser zur Kallusbildung reizt als totes Material Das lückenlose Anheften an den umgebenden Geweben ist eine gute Voraussetzung für Teilnahme des Transplantates an der Konsolidation Jedenfalls bietet Knochengewebe günstiges Material zum Aufbau Im zweiten Falle war der Knochenspan noch 8 Monate nach der Operation deutlich sichtbar

Mein Material ist noch zu klein und die Beobachtungsdauer zu kurz um endgültige Schlussfolgerungen zu erlauben Weitere Versuche mit dieser Behandlung dürften jedenfalls berechtigt sein

### Zusammenfassung.

Der Verf hat in einigen Fällen veralteter Schenkelhalsbrüche einen Knochennagel aus der Femurkortikalis angefertigt und mit diesem die Fragmente zu vereinigen versucht

### Summary.

The author has in some cases of old fractures of the femoral neck made a nail out of the femur corticalis and has tried to join the fragments with this

### Résumé.

L'auteur a dans quelques cas de vieilles fractures du col fémoral, fait un clou osseux du fémur cortical et essayé de réunir les fragments avec ce-ci

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# Prinzipielles zur Behandlung der Schussverletzungen des Gesichts und der Kiefer.

Von

Prof emerit R FALTIN,  
Helsingfors

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Wenn ein Chirurg mit aus mehreren Kriegen gesammelten Erfahrungen sich mit den Verletzungen des Gesichts und der Kiefer abgibt und sich allmählich in dies so schwierige und gleichzeitig so interessante und dankbare Gebiet vertieft, so ist es natürlich, dass die genannten Voraussetzungen seinen Gesichtspunkt und seine Stellungnahme zu allen Fragen auf diesem Gebiete beeinflussen werden. Da man, wie es mir scheint, bei der Diskussion dieser Fragen und überhaupt bei der Behandlung dieser Verletzungen allgemein-chirurgische Grundsätze nicht genügend berücksichtigt hat, mochte ich hier, ohne etwas wesentlich Neues bringen zu können, meine Stellungnahme und die von mir befolgten Behandlungsprinzipien kurz schildern.

Die Voraussetzung für eine erfolgreiche Behandlung der Schussverletzungen des Gesichts und der Kiefer im Kriege ist eine Organisation, die dem Verletzten 1) eine schnelle und richtige erste Hilfe auf dem Verbandplatze bietet, 2) eine baldige und sachgemasse erste Behandlung in einem Feldlazarett oder in einer mit ähnlichen Arbeitsmöglichkeiten ausgerüsteten Sanitätsformation (ev. Kieferambulanz) garantiert und 3) Pflege in einem Sonderlazarett (Kieferstation) bereitet, wo die schwierige und oft langwierige prothetische und plastisch-chirurgische Behandlung zu Ende geführt werden kann. Das Ideal wäre unzweifelhaft die unmittelbare Überführung, wenigstens aller schweren Fälle, in eine Kieferstation in der Heimat unter Verwendung von Flugzeugen.

Dies ist aber zur Zeit nur unter besonders günstigen äusseren Umständen möglich gewesen

Die erste Hilfe bezweckt, ähnlich wie bei anderen Verletzungen, die Beseitigung unmittelbar lebensbedrohlicher Zustände, also die Stillung lebensgefährlicher Blutungen, die Bekämpfung des Schockes, die Behebung der Atembeschwerden, die Stützung des gebrochenen Kiefers und mitunter sogar eine provisorische Aneinanderbefestigung zusammengehörender Gewebe. In den meisten Fällen beruhen die Atembeschwerden, wenn nicht Komplikationen, wie grosse Hamatome oder Verletzungen der Luftwege vorliegen, darauf, dass die Zunge nach hinten gesunken ist, weil sie ihre Befestigung verloren hat, wenn das Kinn entweder weggeschossen oder zerschossen ist. Auch bei doppelseitigen Kieferfrakturen sieht man nicht selten eine ähnliche Verlagerung der Zunge. In allen diesen Fällen kann die Atmungsstörung meistens durch Hervorziehen der Zunge leicht gehoben werden. Nur ausnahmsweise ist eine Tracheotomie wirklich indiziert. Meiner Meinung nach hatte die Tracheotomie in den meisten mir zu Gesicht gekommenen Fällen durch das einfache Hervorziehen der Zunge vermieden werden können.

Beim Hervorziehen kann man die Zunge entweder direkt oder indirekt fassen. Fasst man sie direkt, so macht man es am besten so, dass man mit einer grossen Nadel einen dicken Seidenfaden etwa 2 cm hinter der Spitze quer durchzieht. Eine grosse Klammer- oder Ringnadel kann ebenfalls hierzu benutzt werden. Zieht man die Zunge indirekt hervor, so benutzt man hierzu am einfachsten einen grossen Angelhaken ohne Widerhaken, der von unten entweder in den Unterkiefer oder in ein in der Kinngegend befindliches Fragment eingehakt wird. Im letzteren Falle ist es oft vorteilhafter, das Fragment mit einem Faden aus Seide oder Metall zu umschlingen (circulieren) und daran zu ziehen. An die Mutze des Verwundeten befestigt man einen schlingenförmigen Draht oder einen gabelförmigen Zweig oder eine Cramerschiene um einen festen extraoralen Punkt für den Zugverband zu erhalten. Als Zugkraft verwendet man am besten ein nicht zu dickes, 10 cm langes Drain. Im Notfall kann ein Wafer oder der Verwundete selbst den Zug ausüben. Während des Transportes soll der Verwundete nicht auf dem Rücken liegen, sondern entweder sitzen oder auf dem Bauch liegen. Mitunter kann ein Hervorziehen der Zunge schon durch diese Lagerung allein vermieden werden. Sind die Weichteile vollkommen auseinander ge-

sprengt, so kann es mitunter zweckmassig sein zusammengehorende Teile mit Heftpflaster oder ein Paar Nahten aneinander zu befestigen

Um den gebrochenen Unterkiefer zu unterstützen ist es nicht ratsam, einen das Kinn und den Scheitel umfassenden, stramm angezogenen Verband anzulegen denn ein Komponent des Stützverbandes drückt immer das Kinn und damit den Unterkiefer nach hinten, wodurch erneuert Dislokation der Fragmente und Atembeschwerden entstehen können Viel grosseren Nutzen hat man von einigen Heftpflasterstreifen, die den Unterkiefer möglichst vertikal gegen das Jochbein hochziehen In manchen Fällen von Unterkieferbrüchen scheint es mir bei besonders günstigen äusseren Verhältnissen wohl denkbar, dass man die provisorische Stütze in Form einiger intermaxillaren Ligaturen anlegen konnte, was für den Verwundeten unzweifelhaft wirksamer und viel angenehmer wäre, als ein äusserer Verband

Ist der Oberkiefer teilweise oder vollständig frakturiert, so dass er herunterhängt, so soll er nach oben gehoben werden und in dieser Stellung gehalten werden Dies ist eine ziemlich einfache Aufgabe, wenn der Unterkiefer intakt ist, weil man dann nur die beiden Kiefer mit einem das Kinn und den Scheitel umfassenden Verband gegeneinander zu drücken hat Der Unterkiefer dient dabei als Schiene für den Oberkiefer. Auch kann man den Oberkiefer durch eine quer in den Mund eingeführte Mullbinde, die über dem Scheitel verknotet wird, hochziehen und provisorisch fixieren Sind beide Kiefer zerschossen so kann es nötig werden, die extraorale Extension mit einem Hochheben der Kiefer zu kombinieren

Als schmerzstillendes Mittel ist Morphinum allein selten ratsam wegen der lähmenden Wirkung auf das Atemzentrum In Kombination mit Atropin kann es aber gefahrlos gegeben werden, wobei gleichzeitig die meistens reichliche Salivation herabgesetzt wird Sonst gibt es ja jetzt eine Menge moderner Mittel die Schmerzen zu beseitigen

Die erste wirkliche Behandlung soll so bald wie nur irgend möglich gegeben werden, da die Erfahrung zur Genüge gezeigt hat, von welcher entscheidenden Bedeutung gerade die frühzeitige Behandlung für das weitere Schicksal der Gesichts- und Kieferverletzten ist, ganz wie für die Gehirn- und Bauchverletzten Es ist schliesslich eine organisatorische Aufgabe, die auf verschiedene Weise gelöst werden kann Die Hauptsache ist, dass

die Verwundeten möglichst bald chirurgische und zahnärztliche Behandlung erhalten und in ein Kiefernlazarett übergeführt werden können

Ehe wir auf die erste Behandlung näher eingehen, sei hier daran erinnert, dass diese Kriegsverletzungen in mancher Beziehung eine Sonderstellung einnehmen. Die ausserordentlich guten Zirkulationsverhältnisse im Gesicht schaffen ausserordentliche Heilungsverhältnisse daselbst. Nirgends im Körper ist die Resistenz gegen Infektionen so gross und nirgends sieht man so schnelle Heilungs- und Regenerationsprozesse, wie im Gesicht. Wenn man diese günstigen Umstände nicht zum Besten der Verwundeten ausnutzt, so wenden sie sich in kurzem zum Schaden, in dem Dislokationen von Fragmenten und Verlagerungen von Weichteilen durch Verwachsungen fixiert werden, deren spätere Korrektur dem Verletzten viel Leiden und dem behandelnden Arzt viel Arbeit verursachen. Wenn die Kiefer, die Zähne, die Zunge, und die Lippen beschädigt sind, können schwere funktionelle Störungen entstehen, indem Essen, Sprechen und Atmen behindert werden. Oft sind die im Gesicht liegenden Sinnesorgane gleichzeitig beschädigt und erfordern auch ihrerseits dringend eine baldige Hilfe. Schliesslich, aber nicht an letzter Stelle, spielt jede Gesichtsverletzung eine ausserordentliche Rolle in kosmetischer Hinsicht. Dieser allgemeinen Betrachtungen sollte man sich stets einmessen, wenn man Behandlungsfragen diskutiert.

Eine viel umstrittene Frage ist, ob die primäre Naht oder die offene Wundbehandlung anzuwenden sei. Man scheint die ganze Fragestellung unnutz und falsch zu sein, denn wenn man sie kategorisch in der einen oder anderen Richtung beantwortet und immer danach handelt, wird man oft viel Schaden verursachen. Kieferverletzungen sind ja komplizierte Frakturen und sollten wie diese nach allgemein-chirurgischen Grundsätzen behandelt werden, indem man individuell verfährt und alle auf den Fall einwirkenden Umstände berücksichtigt. Auch bei den Kieferschussverletzungen sollen Wundrevision, wenn sie indiziert ist, sowie auch Reposition und Retention der Fragmente Bestandteile der Behandlung sein. Was die Behandlung dieser Verletzungen von der Behandlung anderer Schussverletzungen unterscheidet, wird von den schon erwähnten ausserordentlich günstigen Zirkulationsverhältnissen, den wichtigen Funktionen und der kosmetischen Bedeutung des Gesichts bestimmt. Alle diese Umstände erfordern eine möglichst baldige und möglichst exakte Re-



konstruktion des verletzten Gesichts in allen seinen Gewebsschichten unter besonderer Berücksichtigung funktioneller und kosmetischer Gesichtspunkte. So kann z. B. eine kleine, nicht korrigierte Dislokation eine sehr storende falsche Okklusion hervorrufen, während z. B. eine frakturierte Extremität lange nicht so empfindlich gegen eine Dislokation ist.

Unter Wahrung dieser Grundsätze vollzieht sich die erste wirkliche Behandlung, meiner Meinung nach, folgendermassen. Wenn die Behandlung nicht in einer Hand liegt, nämlich in der eines chirurgisch ausgebildeten Zahnarztes, was unzweifelhaft das Ideal wäre, sollte immer ein Zahnarzt schon von Anfang an dabei sein. Zuerst wird natürlich der allgemeine Zustand berücksichtigt und festgestellt, ob neben der Verletzung des Gesichts andere vielleicht dringlichere vorliegen. Diese Untersuchung, welche in vielen Fällen ohne Leitung von Röntgenaufnahmen gemacht werden kann, sollte stets unter Schmerzbetäubung, am besten in Leitungsanästhesie, vorgenommen werden. Hierbei sollen alle Umstände, die auf die Behandlung einwirken können, berücksichtigt werden. Zu solchen Umständen gehören die Art der Verletzung, das Alter und die Beschaffenheit der äusseren Wunde, ihre Grösse, ihre Ränder, Komplikationen seitens anderer Gesichtsknochen, Läsionen der Zunge, der Schleimhaut, der Augen, des Gehirns, der Atemwege, u. s. w.

Die Versorgung der Schusswunden im Gesicht kann, ganz wie bei Wunden in anderen Körperteilen, konservativ sein oder muss operativ, d. h. eine Wundrevision sein. Es ist ja einleuchtend, dass nicht alle Wunden, z. B. nicht einfache Durchschüsse, einer operativen Behandlung bedürfen, aber jedenfalls die allermeisten. Die Wundrevision bezweckt ja möglichst günstige Heilungsverhältnisse herzustellen. Deswegen müssen alle nekrotischen Gewebe, vollkommen gelöste Knochensplinter, frakturierte und verlagerte Zähne oder deren Splinter, welche oft in die Zunge oder in die Wangen eingedrungen sind, oder im Bruchspalt liegen, entfernt werden, weil sie sonst hartnäckige Eiterungen unterhalten. Auf die Entfeinerung von Fremdkörper soll man sich bei der Wundrevision nicht einlassen, wenn sie nicht leicht zugänglich liegen oder dringend Abhilfe verlangende Beschwerden verursachen.

Es ist ja selbstverständlich, dass man bei der Behandlung einer Kieferschussfraktur immer eine möglichst schnelle Heilung sowohl der Weichteilverletzung als auch der Fraktur anstrebt, und

dass deswegen der primäre Wundverschluss die Idealbehandlung wäre, ganz wie bei Operationswunden. Schon deswegen kann eine prinzipielle Ablehnung jeder Naht nicht gebilligt werden. Andererseits kann man den Standpunkt weit von der Front arbeitender Zahnärzte und Chirurgen verstehen, die teils nur alte, nicht mehr zur Naht geeignete Fälle zu Gesicht bekommen, teils Gelegenheit gehabt haben, Fälle zu sehen, wo nach einer mit dicken Fäden ausgeführten Naht die Fäden unter reichlicher Eiterung die Gewebe geschädigt oder sogar vollkommen durchgeschnitten hatten. Es ist ja offenbar, dass in vielen von diesen Fällen eine primäre Naht nicht hatte ausgeführt werden sollen, oder wenigstens nicht in der Ausdehnung und in der Weise, wie es gemacht wurde. Aber in Fällen, wo nach unseren jetzigen Anschauungen und allgemein gültigen chirurgischen Prinzipien eine vollständige Vernähung nicht ratsam oder sogar ein Kunstfehler wäre, können und sollen doch zusammengehörige Gewebsteile, besonders in den Lippen, wie das Lippenrot und der Mundwinkel, ferner Augenlider, Nasenflügel, Zunge, Schleimhaut u. s. w. mit einigen Nähten aneinander befestigt werden, während die Wunde im Übrigen offen gelassen oder genügend drainiert wird. Hierbei ist es oft vorteilhaft, einige Entspannungsnahte aus feinem Metalldraht mit zugehörigen Metallplatten anzulegen. Als Nahtmaterial im Gesicht ist übrigens das merkwürdig wenig benutzte Rosshaar besonders zu empfehlen wegen der mangelnden Imbibitionsfähigkeit und der geringen Narbenbildung. Jedenfalls sollten dicke Seidenfäden, die bei eintretender Infektion durchschneiden und hassliche Narben hinterlassen, verpönt sein.

Da blossliegende Fragmente leicht durch Austrocknung nekrotisieren, soll man immer versuchen, sie mit Weichteilen zu bedecken. Eine Ausheilung unter vollkommen offener Wundbehandlung führt meistens zu reichlicher Narbenbildung und zu Schrumpfungen mit allen daraus entstehenden Nachteilen. Bei grossen Defekten kann man diese Prozesse wesentlich vermindern durch Vernähung von Haut und Mundschleimhaut miteinander. So beschaffen, wie die Wunden bei Kieferschussverletzungen meistens sind, wäre es falsch, in jedem Falle eine Exzision und exakte Naht der Wunde zu versuchen. Wie viel Schaden hat nicht ein solches Vorgehen angestiftet, besonders wenn nicht zuvor eine gründliche Wundrevision und eine Reposition mit nachfolgender Schienung der Fraktur ausgeführt wurde. Meiner Meinung nach ist die Immobilisierung, d. h. Schienung, der Kieferfraktur, die

allerwichtigste Massnahme und jedenfalls wichtiger als die Versorgung der äusseren Wunde, weshalb sie auch prinzipiell immer zuerst ausgeführt werden sollte. Durch die Immobilisierung werden nämlich Blutungs- und Infektionsgefahr vermindert, der Verletzte von seinen Schmerzen befreit, die Atmung, das Schlucken (Trinken und Essen) und die Sprache verbessert, während das Entstehen später schwer zu korrigierender Dislokationen, Schumpfungen und Verwachsungen verhindert wird.

Wenn ich hier von Immobilisierung spreche, verstehe ich darunter die Schienung der in möglichst richtiger Stellung und Okklusion reponierten Fragmente und denke hier in erster Linie an die freihändige, ohne Gipsabdrucke ausgeführte Schienung mit Metalldraht. Mit dieser Methode kommt man in den allermeisten Fällen vollkommen aus und alle in den vorderen Sanitätsformationen arbeitenden Zahnärzten sollten sie beherrschen, denn ihnen steht nicht immer ein zahnärztliches Laboratorium zur Verfügung. Auch wäre es nicht unangebracht, wenn die Chirurgen wenigstens einigermaßen die nicht übermässig schwierige Technik beherrschten. In Finnland wurde in den vorderen Formationen eine Zeit lang das von TIGERSTEDT ausgearbeitete »Feldsystem« recht viel benutzt, ohne dass deswegen andere, besonders die in der deutschen Literatur beschriebenen Verfahren vernachlässigt wurden. Hat man die Möglichkeit, rasch auch Prothesenschienen anfertigen zu lassen, so soll man sich natürlich derselben bedienen, weil sie ja in einigen Fällen gewisse Vorteile besitzen. Im ersten Weltkriege habe ich fast alle damals gebräuchlichen Prothesenschienen angewandt. Aus praktischen Gründen haben wir in unseren letzten Kriegen fast ausschliesslich Drahtschienen angewandt.

Das wichtigste ist, wie oben hervorgehoben, die möglichst baldige Ruhigstellung der Fragmente. Sollte die Okklusion dabei nicht immer vollkommen korrekt ausfallen, so ist das von geringerer Bedeutung und kann später im Kieferlazarett meistens ohne grosse Schwierigkeiten korrigiert werden, weil die Dislokation, dank der frühzeitigen Reposition und Schienung, nie einen nennenswerten Grad erreicht haben kann. Für die Versorgung der Wunde spielt der durch die Schienung verursachte Zeitverlust, der höchstens einige Stunden betragen kann, keine Rolle und wird reichlich durch den Gewinn aufgehoben, den die Immobilisierung der schmerzhaften Fraktur dem Verletzten bringt. Ein Aufschieben der Immobilisierung bis zur Verheilung der primär

versorgten Wunde widerspricht allgemein-chirurgischen Prinzipien. Es ist selbstverständlich, dass man, auch wenn man der eben entwickelten Auffassung beipflichtet, gelegentlich schon bei der Wundrevision kleine Weichteilsverletzungen versorgen kann, besonders wenn sie so gelegen sind, dass sie nach Vernähen die Arbeit des Zahnarztes nicht erschweren oder vollkommen verhindern. Grössere Wunden können während der Arbeit des Zahnarztes durch Tamponade geschützt werden. Praktisch werden also die Versorgung des Knochens und der Weichteile beinahe gleichzeitig ausgeführt.

Bei der Reposition und Immobilisierung der Fraktur sollte man nicht nur den Zahne tragenden sondern auch den nicht Zahne tragenden Fragmenten eine gebührende Aufmerksamkeit schenken, denn nur auf diese Weise kann eine totale und zufriedenstellende Rekonstruktion des Kiefers erzielt werden. Die sog. Randfragmente, von denen in erster Linie die Knochenneubildung und die Konsolidation ausgeht, sind ausserdem von grosser kosmetischer und funktioneller Bedeutung. Die ganze Konfiguration des Gesichts hängt oft von ihrer Lage ab. Besonders ist dies der Fall bei den Randfragmenten des Kinns. Sie werden immer von den Muskeln der Zunge und des Mundbodens disloziert mit dem Resultat, dass die Zunge nach hinten fällt, und bis zur Erstickungsgefahr sich steigernde Atembeschwerden entstehen können. Auch wenn das Kinn vollkommen weggeschossen erscheint, findet man oft bei genauem Nachsehen in der Tiefe unter der Zunge kleine Knochenstücke an denen die Zungenmuskeln inserieren. Sie sollten unbedingt hervorgezogen werden und an ihrer normalen Stelle fixiert werden, denn an ihnen haftet alles was noch vom Periost übrig geblieben ist. Von diesen Resten kann eine Knochenneubildung ausgehen, so dass ein normales Kinnprofil entsteht. Tut man das nicht, kann sich im Mundboden eine quer verlaufende Knochenleiste bilden, welche die Funktion der Zunge stört und das ausserordentlich hassliche Vogelgesicht verursacht.

In fast allen meinen Veröffentlichungen habe ich auf diese in funktioneller und kosmetischer Hinsicht so wichtigen Umstände hingewiesen, jedoch wie mir scheint, ohne Beachtung oder Nachfolger gefunden zu haben. Die Kinnfragmente ziehe ich nach vorne mit einem Metalldraht (aus Silber, Bronze-Aluminium oder Kruppstahl) entweder wenn sie gross sind, nach Durchbohrung, oder, wenn sie kleiner sind, mit Ceclage, oder wenn sie ganz

klein sind oder wenn hauptsächlich nur Weichteile mit vermuteten Periostresten zu fassen sind mit einem der lingualen Fläche des Kiefers nachgebildeten, U-förmigen, mit einem Gummidiem umgebenen Drahtbogen. Durch extraorale Extension von einem an einer Gipskappe befestigten Drahtbogen aus werden die Kinnfragmente und gleichzeitig die Zunge hervorgezogen. Anfangs wird die Extension meistens elastisch gemacht. Später, wenn die Knochenneubildung schon im Gange ist und das Kinnprofil wiederhergestellt ist, wird zur völlig fixierten extraoralen Befestigung übergegangen. In geeigneten Fällen kann man natürlich die Randfragmente hervorziehen und befestigen mit Hilfe von intraoralen Schienen oder Apparaten an den Kiefern. Die Hauptsache ist, dass man zielbewusst eine Rekonstruktion des Kinnskelettes anstrebt.

Eine ähnliche Rolle wie die Randfragmente am Kinn spielt der aufsteigende Ast oder was von ihm noch vorhanden ist bei den meisten Frakturen am Kieferwinkel und hinter den Zähnen. Durch den M. temporalis und die übrigen Kaumuskeln wird das hintere Fragment in typischer Weise nach oben, vorne und medianwärts verlagert. Je nach der Beschaffenheit des oder der hinteren Fragmente und der umgebenden Weichteile, wird die Dislokation grösser oder kleiner sein, er zeugt aber immer, wenn sie nicht bei Zeiten korrigiert wird, eine typische, sehr entstehende Vertiefung in der hinteren Backenpartie und im Munde eine entsprechende, störende Ausbuchtung. Überhaupt können die Brüche hinter den Zähnen der Behandlung die grössten Schwierigkeiten bieten. Es ist übrigens eine recht merkwürdige Erscheinung, dass während im ersten Weltkrieg die meisten Kieferchirurgen sich grosse Mühe gaben, das hintere Fragment in die richtige Lage zu bringen und zu immobilisieren, die jetzigen Verfasser sich ziemlich einstimmig darüber keine Sorgen machen und es unberücksichtigt lassen mit der Begründung, dass eine Dislokation belanglos ist und auch bei einer späteren Pseudarthrosenoperation nicht störend ist. Wenn man solche Ansichten veröffentlicht sieht, wäre man geneigt den Unterschied zwischen unseren Ansichten am ehesten so erklären zu wollen, dass wir uns verschiedene Aufgaben gestellt haben. Während ich nicht nur die Konsolidation sondern auch ein kosmetisch und funktionell zufriedenstellendes Resultat anstrebe, begnügen sich, wie es mir scheint, die meisten jetzigen Kieferchirurgen mit einer Konsolidation ohne sich um die hässliche Vertiefung in der Angu-

hinsichtlich zu kümmern. Es ist nämlich ausgeschlossen, dass nicht jeder nur einigermaßen erfahrene Kieferchirurg bei der Operation einer hinter den Zähnen gelegenen Pseudarthrose, die Schwierigkeiten, ja die Unmöglichkeit, das hintere Fragment an seinen richtigen Platz zu bringen, gesehen hatte.

Im ersten Weltkriege versuchte ich durch extraorale Extension in frischen Fällen die Entstehung dieser fatalen Dislokation zu verhindern und in älteren Fällen die schon entstandene Dislokation zu beseitigen, um dem Gesicht die normalen Umrisse wiederzugeben und eine eventuell später nötige Pseudarthrosenoperation zu erleichtern. Ebenso leicht wie es in frischen Fällen gelang, ebenso schwierig, ja hoffnungslos war es meistens in älteren Fällen. Die Erklärung hierfür scheint mir einleuchtend. In frischen Fällen sind es vorwiegend die Muskeln, welche die Dislokation bestimmen, während in älteren Fällen ausser der Verkürzung der beschädigten und degenerierten Muskeln, es vor allem die narbige Schrumpfung ist, welche die abnorme Stellung fixiert. Wird unmittelbar nach den Verletzungen eine extraorale Extension angelegt, welche das hintere Fragment verhindert, in die typische Dislokationsstellung zu geraten, so verbleiben die Tonusverhältnisse in den Muskeln normal und eine Degeneration mit Elastizitätsverlust entsteht nicht, ebensowenig wie im allgemeinen nach aseptisch verheilten Unterkieferresektionen. Aber das allerwichtigste ist, dass das Granulationsgewebe und das daraus später sich entwickelnde Narbengewebe, welches in eiternden Schusswunden ja immer entsteht, schon bei der Entwicklung so belastet wird, dass es Entwicklungsmechanischen Gesetzen gemäss, einen vorteilhaften und in erwünschter Richtung dehnbaren Bau erhält. Macht man während der Verheilung keinen Versuch der Dislokation entgegenzuarbeiten, so entstehen dagegen regelmässig fast undeformbare Schrumpfungen.

Das wirksamste Vorbeugungsmittel ist die extraorale Extension von einer Gipskopfkappe aus. Beim Anbringen dieser Extension am Knochen sind die Autoren in verschiedener Weise vorgegangen. Niemand ist mit seinem Verfahren vollkommen zufrieden gewesen. Auf alle die verschiedenen Verfahren soll hier nicht näher eingegangen werden. Von dem neulich von ULLIK beschriebenen, grundsätzlich verschiedenen Verfahren, habe ich keine Erfahrung. Sein Verfahren setzt eine gut sitzende Prothe-

senschiene am Unterkiefer voraus während das Kopfkappenverfahren in allen Fällen anwendbar ist

Im ersten Weltkriege legte ich nach Durchbohrung des hinteren Fragmentes, womöglich am Angulus, eine Drahtöse an, welche zum Ende eines an einer Kopfkappe befestigten Drahtbogen gezogen wurde. Um die Durchbohrung zu umgehen und das Anlegen der Extension zu vereinfachen, konstruierte ich (im ersten Weltkriege) verschiedene Haken, die das hintere Fragment von der lingualen Seite fassen sollten, zuletzt einen, bei dem eine zusätzliche Schraube das Fragment von der äusseren Seite fasste. Mein früherer Assistent SOIVIO hat in diesem Kriege von derselben Idee ausgehend ein recht brauchbares Instrument konstruiert. Das einfachste und sicherste Verfahren, das hintere Fragment zu fassen, verbleibt jedoch immer die Durchbohrung des Angulus oder die Umschlingung (Cerclage) eines in der offenen Wunde sich bietenden Fragmentes. Wenn man einen recht feinen Draht zur extraoralen Extension benutzt und die beiden Enden fest umeinander dreht in einer Ausdehnung, welche der Dicke der Weichteile entspricht, ragt aus der Haut nur der feine Doppeldraht hervor. Die kleine Extensionsöse wird ausserhalb der Haut gebildet, erst durch Auseinanderziehen und dann durch Zusammendrehen über irgend einem cylindrischen Gegenstand von höchstens 1 cm Durchmesser gebildet. In dieser Weise angefertigt, kann die Extensionsöse monatelang funktionieren, ohne die Weichteile zu irritieren.

Von Pelotten und verschiedenen Aufbissen habe ich keine sehr günstigen und deswegen auch ziemlich beschränkte Erfahrungen. In einigen frischen Fällen haben sie sich bewahrt, besonders in Verbindung mit extraoraler Extension. In anderen, namentlich in älteren Fällen, ist es zu Schmerzen und sogar zu Decubitus gekommen, ohne dass man die Entwicklung der typischen Deformität hatte verhindern können. In dem finnisch-russischen Kriege 1939—1940 liess ich mich durch das moderne Schrifttum verleiten, in einigen Fällen von meinen Grundsätzen abzuweichen, was ich später nur habe bereuen müssen. In solchen unbehandelten Fällen war es fast unmöglich, die Dislokation durch extraorale Extension später zu beseitigen. Wenn dies bei der späteren Pseudarthrosenoperation, wo doch das hintere Fragment freigelegt und aus den Narbenmassen befreit wird, nicht gelang, musste mitunter zur Resektion des Processus coronoides geschritten werden. Nach Entfernung der extraoralen Extension in frischen Fäl-

len werden die Patienten aufgefordert taglich vom Mund aus durch Fingerdruck das hintere Fragment nach aussen und hinten zu drucken, wahrend sie die gunstige Zeit fur die Pseudarthrosenoperation abwarten

Bei der Versorgung der Weichteile soll, wie schon oben hervorgehoben wurde, der Zunge und der Schleimhaut gebuhrende Aufmerksamkeit gewidmet werden. Einer zerrissenen Zunge sollte man immer versuchen, die normale Form wiederzugeben um die Bildung funktionell ungunstiger Verwachsungen zu verhindern. Der Defekt in der Mundschleimhaut ist selten gross auch nicht bei Wangen- und Kinnverletzungen, wo man beim ersten Anblick geneigt ware, einen gewaltigen Schleimhautdefekt anzunehmen. Da die Schleimhaut sehr dehnbar ist, sollte man immer, wenn der vollstandige Verschluss nicht gelingt, versuchen, eine grosse klaffende Wunde in denselben wenigstens zu verkleinern, um nicht grosse schleimhautfreie Flachen im Munde zuruckzulassen. Tut man das nicht, konnen schwere Verwachsungen mit den Alveolarfortsatzen entstehen so dass die Umschlagfalten in den Fornices verschwinden und eine spatere Prothetisierung sehr erschwert oder erst nach einer Fornixoperation moglich wird. In manchen Fallen konnen, wie schon oben hervorgehoben wurde, Narbenbildung und Schrumpfung bedeutend verringert werden, wenn man schon bei der Wundrevision die Schleimhaut mit einigen Nahten an die Haut befestigt.

Auch der Zahnarzt sollte schon bei der ersten Schienung seine Aufmerksamkeit auf die Vorbeugung der Entstehung dieser Verwachsungen richten und zwischen epithelfreien Flachen immer eine, am besten mit Guttapercha bekleidete Schiene oder Pelotte befestigen. Deswegen sollte er auch in Fallen, wo zu immobilisierende Fragmente nicht vorhanden sind, wie z. B. wenn der eine Oberkiefer weggeschossen ist, durch eine geeignete Vorrichtung Verwachsungen verhindern und den Weichteilen eine formgebende Stutze geben. Dadurch konnen Schrumpfungen verhindert werden was fur spatere plastische Operationen oft von grossem Wert ist. Nebenbei sei bemerkt, dass ich mich bei plastischen Operationen mit Vorliebe des runden Stieles bediene, weil man mit dieser Methode fast unbegrenztes Material erhalten kann ohne Narben im Gesicht zu verursachen. Die verhaltnissmassig lange Dauer solcher Plastiken ist allerdings ein Nachteil.



Wie ersichtlich sind hier nur die Prinzipien der Behandlung der Schussverletzungen des Gesichts und der Kiefer, besonders im frischen Stadium, berücksichtigt worden, weil die erste Behandlung die allerwichtigste und für das weitere Schicksal des Verletzten oft von ausschlaggebender Bedeutung ist. Wenn die Verletzten dank einer zufriedenstellenden Organisation innerhalb der zwei ersten Tage nach der Verletzung eine geeignete Behandlung erhalten können, wird die endgültige Behandlung in den Sonderlazaretten sich verhältnismässig einfach gestalten und den Patienten viel Leiden und Zeitverlust erspart werden.

### Zusammenfassung.

Die Voraussetzungen für eine erfolgreiche Behandlung dieser Verletzungen im Kriege ist eine Organisation, die den Verletzten eine zweckmässige erste Hilfe auf dem Verbandplatz, eine baldige erste Behandlung in einem Feldlazarett und eine endgültige prothetische und plastisch-chirurgische Behandlung in einem Sonderlazarett bereitet. Da Schussverletzungen der Kiefer komplizierte Frakturen sind, sollen sie nach allgemeingültigen chirurgischen Regeln behandelt werden. In den meisten Fällen ist eine Wundrevision indiziert. Das Ziel der Behandlung ist eine Rekonstruktion des verletzten Gesichts in allen seinen Gewebsschichten mit besonderer Berücksichtigung kosmetischer Gesichtspunkte. Die Rekonstruktion wird von innen nach aussen ausgeführt und beginnt also im Munde. Grundsätzlich sollte die Immobilisierung der Fraktur als der wichtigere Teil der Behandlung immer vor der Versorgung der Weichteilswunden ausgeführt werden. Bei der Rekonstruktion des Kiefers sollen nicht nur die zahntragenden Fragmente berücksichtigt werden, sondern auch die Randfragmente am Kinn und die Fragmente hinter den Zähnen, wegen ihrer kosmetischen Bedeutung. In den meisten Fällen muss man dann zur extraoralen Extension greifen. Bei der Immobilisierung der Fraktur kann man meistens mit der feierhandigen Drahtschienung auskommen. Die Weichteilswunden sollen individuell nach allgemeingültigen chirurgischen Regeln behandelt werden, indem man zusammengehörende Teile an einander befestigt, entblösste Knochenteile mit Weichteilen bedeckt und für genügende Drainage sorgt. Ein vollkommenes Ausschneiden der Wunde mit nachfolgender exakter Naht ist selten angezeigt.

ebensowenig wie ein vollkommen Offenlassen derselben Um Schumpfungen und Verwachsungen vorzubeugen werden bei Zeiten stützende Prothesen für die Weichteile angelegt

### Summary.

The conditions for a successful treatment of these injuries during war-time is an organization which can give the wounded an effective first aid on the dressing-station, a speedy first treatment in a field hospital and a final prosthetic and plastic-surgical treatment in a special hospital As bullet wounds of the jaw are complicated fractures, they should be treated according to general surgical rules In most cases a wound-revision is indicated The aim of the treatment is a reconstruction of the wounded face in all its tissues with special reference to cosmetic points of view The reconstruction is performed from the interior parts to the exterior, and thus begins in the mouth Principally the immobilization of the fracture, as the most important part of the treatment, should always be performed before the treatment of the soft parts At reconstruction of the jaw not only the fragments with the teeth but also the border fragments of the chin and the fragments behind the teeth ought to be borne in mind, because of their cosmetic importance In most cases one must then resort to extra-oral extension When immobilizing the fracture one can mostly do with a wire without the aid of instruments The soft part wounds should be treated individually according to general surgical rules, by attaching parts belonging together, by covering exposed osseous parts with tissue and by effecting satisfactory drainage A complete excision of the wound with subsequent exact suture is seldom to be recommended, nor is the wound left completely open In order to prevent atrophies and deformities a supporting prosthesis for the soft parts is sometimes applicated

### Résumé.

Les conditions d'un traitement bien réussi de ces blessures pendant la guerre est une organisation qui donne au blessé une première aide effective à la poste de secours, un prompt premier

traitement dans une ambulance et un traitement prothétique et plastique-chirurgical final dans un hôpital special

Comme les blessures de coup de feu de la mâchoire sont des fractures compliquées elles doivent être traitées selon des règles chirurgicales générales. Dans la plupart des cas une revision de la blessure est indiquée. Le but du traitement est une reconstruction du visage blessé dans tous ses tissus spécialement en considérant les points de vue cosmétiques. La reconstruction se fait de l'intérieur à l'extérieur, et commence ainsi dans la bouche. En principe l'immobilisation de la fracture, étant la partie la plus importante du traitement, doit se faire toujours avant le traitement des blessures des parties molles. En reconstruisant la mâchoire on ne doit pas seulement considérer les fragments portant les dents mais aussi les fragments de bordure du menton et les fragments derrière les dents à cause de leur importance cosmétique.

Dans la plupart des cas on est obligé de faire une extension extra-orale. En immobilisant la fracture on peut le plus souvent employer un arc métallique à main levée. Les blessures des parties molles doivent être traitées individuellement selon des règles générales chirurgicales en attachant des parties appartenant l'une à l'autre, en couvrant les parties osseuses exposées avec des parties molles et en effectuant un drainage satisfaisant. Un découpage total de la blessure suivi par une suture exacte n'est pas souvent à conseiller. On ne doit pas non plus la laisser complètement ouverte. Afin de prévenir des fletrissements et des déformations des prothèses à l'appui des parties molles sont quelque fois appliquées

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## Osteosynthesis of Medial Fractures of the Femoral Neck with the Aid of Three Nails ("Multiple Nailing").

By

GUNNAR NYSTROM

Late Professor of Surgery at the University of Uppsala

In a paper on the treatment of medial fractures of the femoral neck, published in the »*Ergebnisse der Chirurgie und Orthopädie*» (Vol 31, 1938), I pointed out that the method of nailing these fractures with a three-flanged Smith-Petersen nail, though superior to the earlier methods of nailing with a single round or angular nail, or a screw, yet left much to be desired from a mechanical point of view. The three-flanged nail, it is true, counteracts a rotation of the femoral head, but only with short levers (the flanges). It does not sufficiently prevent small tottering movements between the fragments, when they are not exactly reduced. Difficulties do not seldom attend the extraction of a nail and its readjustment in a more favourable position. Moreover, the necessary holes in the femoral shaft are relatively large and may result in fissures and a weak hold of the outer end of the nail which favours its slipping out.

When a carpenter wishes to join two pieces of wood firmly together by nailing, he uses at least two nails. Though usually unversed in theoretical mechanics, and guided merely by sound practical experience, he places them in such positions that they not only keep the pieces of wood together but also oppose bending and turning movements between them.

This common sense procedure has also been applied to the nailing of fractures of the femoral neck (BACKER-GRONDAHL, SCHILLING, TELSON and RANSOHOFF, SOFIELD, DYAS and ARIES, GAENSLER, BOSWORTH, MOORE, and probably others<sup>1</sup>). Experiences from this procedure have been rather contradictory, and it has not aroused so much interest and sympathy as the methods based

<sup>1</sup> Literature references in the author's paper in *Ergebnisse der Chirurgie und Orthopädie* Vol 31, 1938.

on the three-flanged Smith-Petersen nail Investigations, suggested by TINKER (1) and carried out by Prof SAWDON at the Dept of Experimental Engineering of Cornell University in 1939, have shown, however, that the nailing of a subcapital fracture of the femoral head with more than one nail, even of a thinner type (MOORE), gives better fixation than the three-flanged Smith-Petersen nail

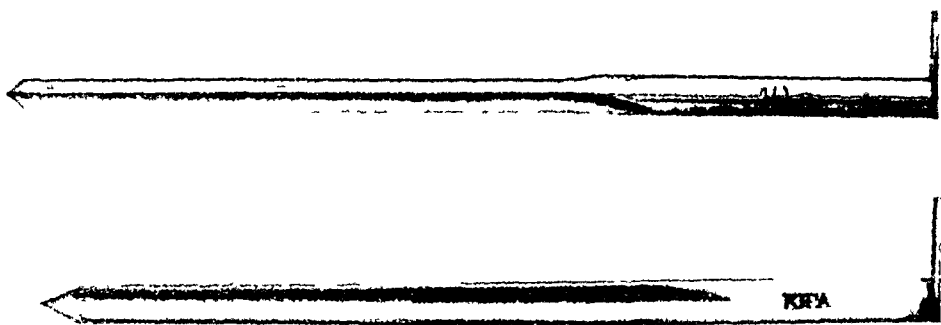


Fig 1 Triangular (a) and quadriangular (b) nail used for multiple nailing at the Uppsala Clinic

Having used the method of nailing fractures of the femoral neck according to SVEN JOHANSSON, with the aid of cannulated Smith-Petersen nails, for several years and in nearly 100 cases we found the results not so satisfactory as we had hoped after the brilliant achievements of SVEN JOHANSSON, though much superior to what had been attained with the earlier Whitman plaster of Paris method. Bearing in mind that the above-mentioned working hypothesis might be applicable to our problem, we decided to try "multiple" nailing, as I shall call the procedure in the following text.

It seemed probable to us that the thin nails (or, rather, needles), used by MOORE, CALDWELL and BOSWORTH, would not give sufficient support, or run the risk of being broken or bent, a figure in BOSWORTH's paper shows bending of all the nails — Kirschner wires — in a bundle of four of them, with consequent dislocation in the fracture. We therefore decided to try somewhat thicker nails while retaining something of the idea of the Smith-Petersen nail by concavating the part of the nail intended for the femoral head on three sides, and so giving it a kind of *three-flanged shape* (Fig 1 a). The outer end of the nail, which was round, was furnished with a tongue of soft steel designed to lean against the surface of

the femoral shaft in order to prevent the nail from sinking into the bone. The nails were given a calibre of 5 mm.

The nails were inserted with the help of a handle screwed into the end of the nail. The further details of the procedure will be explained in the description of the final armamentarium and its use, as they have gradually evolved from our experiences.

The method seemed to be satisfactory. But we had to overcome several drawbacks in the *steel material*. Some of the alloys of rustless steel were found to be too weak — and the nails bent under the load. Other alloys proved too brittle — thus, in not less than 30 per cent of the cases the nails of the above-mentioned calibre have broken. In spite of the kind cooperation of the Sandviken Works, the world-renowned specialists in high quality steels, it was impossible to obtain an adequate strength for these light nails. Remarkably enough, a nail occasionally broke after a lapse of several months, or even  $1/2$ —1 year after the operation, when signs of osseous healing were already apparent. These late nail-fractures must result from bending forces which gradually increase in conjunction with changes of form in the fracture region of the bone during the process of regeneration. In most of the cases the breakage of one or even two nails seems to have been without influence upon the final consolidation of the fracture. But in some instances the breaking of the nails resulted in a loosening of the fragments and final pseudarthrosis.

It therefore seemed to be necessary to increase the calibre of the nails. For the last two years we have used *quadrangular nails* (Fig. 1 b) with concavation of the sides, as mentioned above, and with the part intended for insertion in the head gradually tapering towards the point, thus facilitating its penetration and decreasing the risk of rotation of the head by its introduction — which is a not unusual cause of failure of an operation when osteosynthetic material of greater calibre is used. The outer unexcavated part of the nail has a breadth of 5 mm.<sup>1</sup>

The armamentarium now used in the clinic is reproduced in Figs. 2—3.

The operation procedure is very simple.

1) Preliminary reduction in bed by means of wire traction, usually applied to the tuberositas tibiae, or traction with adhesive plaster, during 1—3 weeks.

<sup>1</sup> The steel now used is stainless, analysis 4 C 27, degree of hardness Vickers approx. 440 units.

2) Spinal or local anaesthesia in bed during maintained traction

3) The patient is moved to an orthopaedic operating table without releasing the traction (maintained manually) Definite reduction with inward rotation Control of the distance spinal intervals — upper border of the patella, which must be the same for both legs in the same position

4) A darning needle is thrust through the skin as a guide and hammered in a few millimetres into the shaft of the femur in the

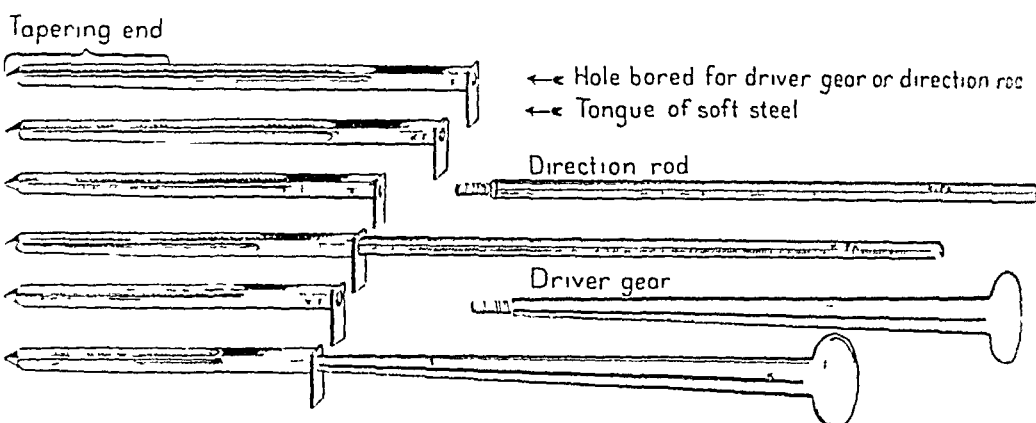


Fig 2 Armamentarium for multiple nailing

region where one counts upon introducing the nails. A Michel clamp is fastened in the skin at the cross-point between the femoral artery and the inguinal ligament, indicating the femoral head in a frontal view. Roentgen pictures are taken with posterior and lateral positions of the cassette, the latter with one side of the cassette carefully in the horizontal line (the table is supplied with a cassette box at its pelvic part to facilitate the placing of the cassettes for the antero-posterior exposition).

5) If the reduction proves to be satisfactory, a longitudinal incision, which need usually be no longer than 8 cm, exposes the femoral shaft along the darning needle. With the guidance of the Roentgen picture and the needle (the point of which should be visible in the picture) it is easy to choose a place suitable for the insertion of the first nail. Here a hole of about 5 mm in diameter is bored with a common drill in the corticalis of the femoral shaft in the direction of the femoral head. With the aid of the frontal picture a rough estimate of the desired length of the nail is made (usually  $\frac{2}{3}$ , or a little more of the measured nail track in the Roentgen picture). A nail of this length is hammered in, pointing to the clamp in the loin as seen anteriorly and with the desired

inclination to the table plane (usually parallel to it) as judged from the lateral Roentgen picture. Then, Roentgen control (Figs 4—5)

6) If the nail has a good position within the neck and the head of the femur and is of proper length (the point ought not to approach the bone-cartilage border of the femoral head more than 1 cm), the driver gear is removed from the nail and the guiding rod screwed to it

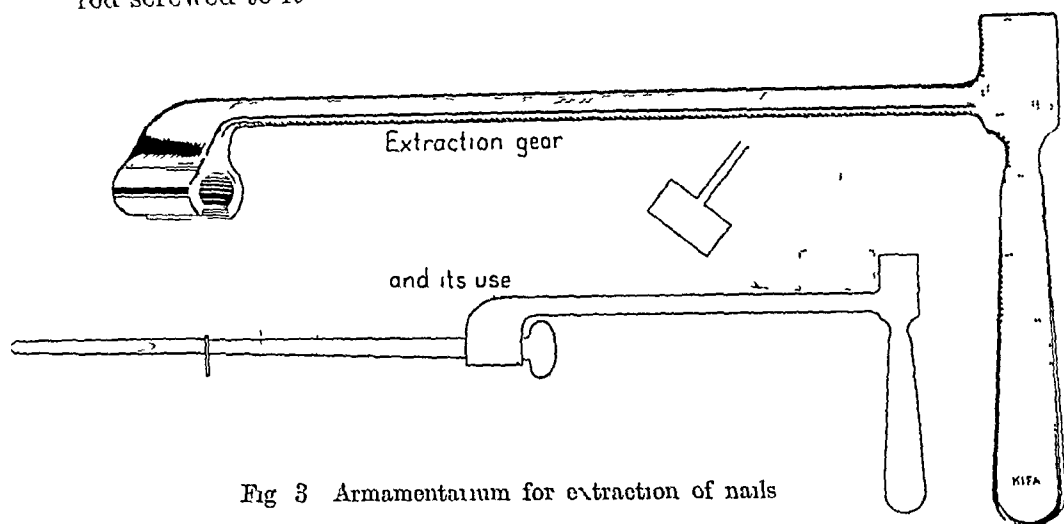


Fig 3 Armamentarium for extraction of nails

7) Another two bore-holes are made in the femoral shaft in suitable places near the first one (preferably a little before or behind it, to avoid the risk of longitudinal fissures in the bone). Guided by the direction rod of the first nail, or, if desired, with the aid of a simple adjustable anglemeter, the surgeon can easily give the proper course to the two nails now inserted. The desired length of these nails is calculated exactly from the Roentgen picture of the first nail. The nails ought to be spread in the femoral head.

8) A nail which is proved by the Roentgen pictures to have taken a bad course has to be removed with the aid of the extraction gear and reinserted in a better direction. A new nail is substituted for one which proves to be too long or too short.

9) If necessary, the blade of soft steel at the outer end of the nails is bent on to the surface of the bone by means of a few blows of the hammer (with the help of a steel pin)<sup>1</sup>

<sup>1</sup> In the beginning, we attached the blade to the femoral shaft with a small screw, inserted through a hole in the blade, in order to prevent a slipping out of the nail. But after having experienced that the small screws often got loose from the bone and that the blade usually kept the nail in a desired position without special fixation, we abandoned the screws.



The nails are manufactured by the Kirurgiska Instrument Fabriks Aktiebolaget (KIFA) in Stockholm at lengths of 7–12 cm, with differences of  $\frac{1}{2}$  cm. The nails most commonly used have a length of about 10 cm.

One advantage of this method is its *simplicity*. No complicated apparatus is required for directing the nails. The first probatory

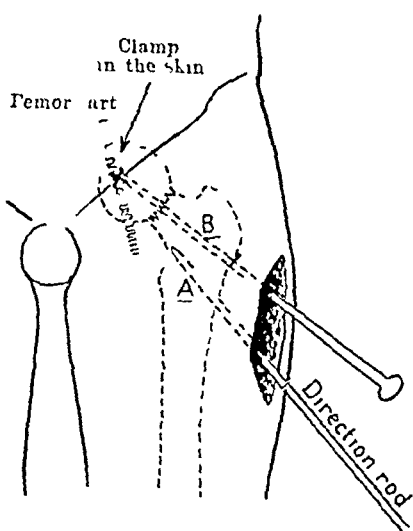


Fig 4 The first introduced nail (A) has a bad position. The direction rod is screwed on, and with the guidance of this and the Roentgen pictures, a new nail is introduced (B) and immediately adopts a good position.

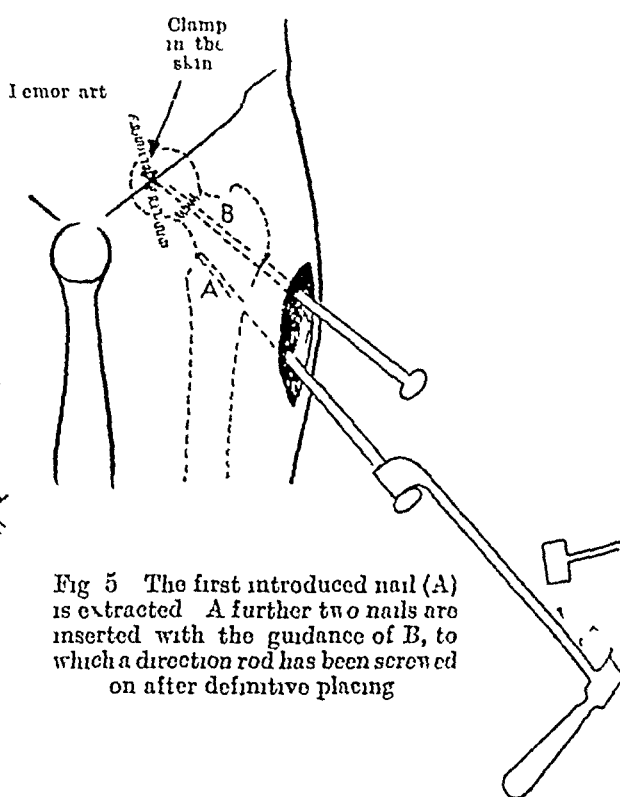


Fig 5 The first introduced nail (A) is extracted. A further two nails are inserted with the guidance of B, to which a direction rod has been screwed on after definitive placing.

nail inserted, and its prolongation in the direction rod screwed to its end, give the suitable point of introduction and the proper angle for the following nails. If one of the nails has to be changed, the other nail or nails will keep the fragments fixed while the new one is inserted.

One is not so dependent on the position of every individual nail as in the case of the single Smith-Petersen nail. As pointed out above, the nails ought to be spread in the femoral head. But a strict rule for their position in relation to each other seems unnecessary. Yet, too horizontal a position, i.e. too high an insertion in the femoral shaft, has to be avoided. Good positions for the nails are exemplified in Fig 6.

With the aid of the extraction gear, the *changing of nails*, or of their position, is very easy and should certainly be undertaken if desirable

It seems quite possible that a nail channel, left in the femoral head after extraction, may be of advantage for the revascularization of its structures (principle of treatment of pseudarthrosis according to BECK, BOZSAN (2) has applied this principle to the treatment of the intra-capsular fractures of the femoral head by making 6—9 bore-holes through the femoral neck and head, as a preliminary to the plaster of Paris treatment according to WHITMAN)

The ease with which the nails can be extracted makes one *more willing to change them or their position even later on (in local anaesthesia), should this seem desirable* — for instance, when the point of a nail is beginning to penetrate the cartilage of the femoral head during the common secondary impaction of the fragments with the resulting abbreviation of the nail track. In order to allow space for such a secondary penetration towards the joint, I recommend not driving the point of the nail closer than 1 cm. to the cartilage of the femoral head. Roentgen controls are necessary at least once a month during the first half-year. *And I think it ought to be an essential rule of procedure that the nails should be changed if their position appears to deteriorate*

As judged from two of my cases, a *perforation of the caput during the operation*, with extraction of the perforating nail carried out on the same occasion, does not seem to impair the prognosis noticeably (see p. 462—463). Even when a *perforating nail is exchanged only after the lapse of some months*, the result may be fully satisfactory (see p. 463).

It is of some interest to compare *the degrees to which bone tissue is injured by different types of nails*. It has been suggested (LINTON and others) that the three-flanged Smith-Petersen nail is apt to induce necrosis of the femoral head by too extensive crushing of the spongiosa and severing of its blood-vessels. As to the extent of damage to the spongiosa, a comparison between the apical 4 cm. of the usual Smith-Petersen nail and my nails has shown that the S-P nail displaces a volume of 1.2 ccm. water, whereas the corresponding part of my formerly used thinner triangular nails displaces 0.2 ccm. and the thicker quadrangular nails now used displace 0.5 ccm. Three of the thinner triangular nails thus displace the spongiosa of the femoral head 50 % less and three of the thicker quadrangular nails 25 % more than does the Smith-Petersen nail. It seems to be possible that damage may be caused to the bone not only by displacing the lamellae of the cancellous bone, but also by severing the blood-vessels. The flanges of the S-P nail may be more harmful to the blood supply in such a way

## Clinical Material

Since January 1938, when multiple nailing was introduced at the surgical clinic of the University of Uppsala, up to the end of April 1944, 242 cases of medial fractures of the femoral neck have been admitted to the clinic

I	Non-operated cases	59 = 24 %	24 %
II	Nailed according to Sven Johansson's method	7 = 3 %	76 %
III	Nailed according to the author's method		
	a) with the lighter triangular nails (Jan 1938—Dec 1941)	79 = 33 %	
	b) with the heavier quadrangular nails (from May 1941)	97 = 40 %	

In group III a few cases are included from the period of transition to the heavier nails, where one quadrangular nail was used, besides two triangular nails. Group III b contains a few cases where one of the triangular nails was used, together with two quadrangular nails.

### I Non-operated cases.

#### Age.

	30—39	40—49	50—59	60—69	70—79	80—89	> 90	Total
Males	1	1	2	1	5	6	2	18
Females		1	5	6	11	17	1	41

### Mortality during period of stay in hospital

18 of 59 = 30.5 %

Causes of exclusion from operative treatment	Number of cases
«Impaction» in valgus or correct position (in 2 cases only fissure)	25
Senile debility, complicated in certain cases with pneumonia, senile gangrene, cerebral thrombosis, etc.	24
Fat embolism and death within 2 days	1
Haemorrhagic cystitis	1
Fever, pulmonary embolism, death after 2 weeks	1
Perforating ulcer of duodenum, death after 2 weeks	1
Operation declined by the patient	2
Moved to county where resident	1
Not noted	1

## II. Operated on according to Sven Johansson's method.

7 cases in the first year after the introduction of the author's method Without special interest in this connection

A penetrating study of the results of the nailing of these fractures according to the (Smith Petersen) Sven Johansson method has recently been published by P LINTON in the Acta Chirurgica scandinavica, Vol XC, Suppl 86

## III. Multiple nailing according to the author's method.

With few exceptions the cases operated on were typical, loose, adduction (varus) fractures Well impacted fractures have been treated conservatively (see above table) Nailing has been carried out only in a few cases of "impacted" fractures of different types (valgus or varus fractures) or fractures without dislocation, when the impaction has seemed to be unreliable

a Nailing with lighter triangular nails, 79 cases

Age.

	20—29	30—39	40—49	50—59	60—69	70—79	80—89	> 90	Total
Males	1	1	3	4	8	6	1	—	24
Females			1	8	17	23	6	—	55

### Mortality

15 of the 79 cases died within 2 years

	Sex	Age	Time after operation	Cause of death
1	W	80	same day	Diabetes
2	W	86	one day	Fat embolism (brain and lungs)
3	W	64	1½ month	Arteriosclerosis cerebri, cordis, renum Decubitus
4	M	81	1 »	Pulmonary embolism
5	W	79	1 »	Arteriosclerosis Decubitus Sepsis Senile psychosis
6	W	83	1½ »	Acute cholecystitis and peritonitis
7	M	75	2 »	Arteriosclerosis Acute bronchitis
8	W	57	2 »	Arteriosclerosis
9	M	66	2 »	Cardiosclerosis Psychosis
10	W	69	3½ »	Marasm Psychosis
11	W	82	3½ »	Pulmonary embolism (without warning!)
12	W	71	4 »	Cardioarteriosclerosis
13	M	65	6 »	Diabetes
14	W	70	22 »	Unknown cause
15	W	78	23 »	Cardioarteriosclerosis

Nos 1, 2, 3, 4, 6 and 11 of these cases (= 7 6% of total) died in the hospital, the others after discharge from the hospital

## 3 died after more than 2 years

	Sex	Age	Time after operation	Cause of death
1	W	80	26 months	Cerebral haemorrhage
2	M	54	34 "	Epilepsy
3	M	76	38 "	Fracture of the other femoral neck

## Patients alive followed up for more than 2 years

Of the remaining 61 patients, all but two have been followed up for more than 2 years, but in 6 of these cases there has been no opportunity to get a Roentgen control after the 2-year period. However, among the cases Roentgen-controlled for more than 2 years 4 cases of pseudarthrosis are included, where a definite or probably definite non-union was established at the Roentgen examination 10, 14, 20 and 22 months, respectively, after the operation and where a new Roentgen examination after the 2-year period seemed unnecessary for judging the result of the operation.

Thus, 53 cases remain which have been controlled roentgenologically after more than 2 years, or in which a definite non union had been established before that time.

One of these cases, a woman aged 68, showed a peculiar change in the region of the injured hip joint. In the surroundings of the joint, huge masses of bone developed after the operation, gradually attaining the size of a coconut and obscuring all details on the Roentgen picture. No signs of tabes. Wassermann reaction negative. Microscopic examination of excised pieces of the neoplasm showed bone and purulent granulation tissue, but no signs of tumor. The process was interpreted as an abnormal reaction to a mild infectious arthritis and peri arthritis. This case is excluded from the following calculations.

## Osseous union.

Osseous union was obtained in 45 of the remaining 52 cases (86.5%). In 5 of the 7 cases of pseudarthrosis, *breakage of nails* seems to have contributed to, or been the main cause of, the disintegration (Fig 7). The common occurrence of breakage of these thin nails (though mostly of no serious consequences for the healing) gradually made it seem likely that stronger nails were desirable. And the experience of *pseudarthrosis arising from such breakages* was decisive for our change-over to the heavier quadrangular nails.

In the other two cases of non-union *slipping out of the nails from the femoral head* has been the cause of the redislocation.

## Necrosis of the femoral head.

Necrosis of the femoral head occurred only in 5 cases (9.6 %) (Fig 8—12). One of these cases was a valgus (abduction) fracture with good impaction, which was *not* loosened before the nailing, the other 4 were varus (adduction) fractures of the typical loose kind, with outward rotation of the femoral shaft (in one of the cases resulting in pseudarthrosis)

To these cases we should possibly add one of the cases of pseudarthrosis, where the femoral head showed a relative sclerosis. With this case the frequency would rise to 11.5 %

This shows a remarkably low frequency of necrosis. Most reports on this complication resulting from nailed medial fractures of the femoral neck give much higher figures.

SVEN JOHANSSON<sup>1</sup>, it is true, reported only 2 cases of necrosis of the head in a series of 139 cases of intracapsular fractures nailed according to his method and discharged alive from the hospital. And BENDIXEN<sup>1</sup> found by examination of a Roentgen series of 112 cases of fracture of the femoral neck (subcapital, intermediate and lateral, the numbers of each category not being recorded) only 10 cases of necrosis of the head (6 in nailed and 4 in *non-operated* cases). But in both these series the observation time, which is not noted, may have been too short in a great part of the material.

CEDERMARK<sup>1</sup> saw 4 cases of necrosis of the femoral head out of 17 medial fractures (23.5 %), FELSENREICH<sup>1</sup> 23 out of 70 (32.9 %), BOHLER-JESCHKE<sup>1</sup> 11 out of 26 (42.3 %) cases followed up for more than 1½ year. In the *author's* series of 35 cases, operated according to Sven Johansson and followed up for more than 2 years, there were 10 cases of necrosis (28.6 %). SPEED<sup>1</sup> estimates the frequency of necrosis in nailed fractures as 34 %.

Recently (1944), LINTON (3) has collected 365 cases of intracapsular fractures of the femoral neck treated in two large Stockholm hospitals. He had been able to observe 81 cases of varus (adduction) fractures, treated according to SVEN JOHANSSON, more than 2 years after the operation. Not less than 32 of these showed signs of necrosis, i.e. a frequency of  $39.5 \pm 5.43$ . Corresponding to this material, my series (up to June 1, 1941, stated in a lecture in June 1943, not printed) includes 43 cases of varus (adduction) fractures with 4 cases of necrosis, i.e. a frequency of  $9.3 \pm 4.48$ .

The difference is statistically significant and seems to show that

<sup>1</sup> Literature references in the author's paper in *Ergebn d Chir und Orthop* Vol 31, 1938.

<sup>2</sup> This series has been controlled by Linton and its comparability with his own material verified.

the *method of multiple nailing with three thin nails* used at the Uppsala Clinic is less harmful to the blood supply of the femoral head than that of the single three-flanged Smith-Petersen nail, or, what seems to me to be a more probable cause of the difference in the frequency of necrosis of the head, *creates more favorable conditions for the regeneration of nutrition by former fixation of the fragments to each other*

### Arthritis

A diminished height of the joint cartilages, as the sole objective sign of an arthritis, has been observed in four cases as a sequel of *necrosis of the femoral head*

In one case, *penetrating nails* have been the probable cause of grave arthrosis deformans which developed gradually after the operation and compelled us to perform an arthrodensis operation. As has been mentioned above, the penetration of nails need not necessarily lead to such consequences. But this must be presumed to be the case only when injury to the joint is not too extended or protracted. The risk of serious arthrosis processes will certainly increase when a penetrating nail is left in position. Therefore it must be a rule, as pointed out above, repeatedly to control the position of the nails and to exchange a nail which threatens to penetrate into the joint.

In three cases with low-grade signs of arthrosis (decreased cartilage height), no evident cause for this change has been found. In another case the height of the cartilage was diminished already at the time of the operation, and no progress could be demonstrated in degeneration of the cartilage after nearly three years.

Finally, there have been two cases of probably *infectious* arthritis. One of these, with a peculiar development of huge bone masses in the joint region has been mentioned above (p. 458). In the other case, pus (without bacteria in a smear) was obtained from the channel of an extracted penetrating nail, and the process resulted in ankylosis.

### The functional results

It can easily be understood that a valuation of the functional results of the treatment of fractures of the femoral neck is rather delicate and hazardous. A large part of the patients have reached the higher ages, in which bodily and mental powers have already been debilitated or are gradually sinking, and in which the functions of the lower extremities are especially impaired — often in connection with senile degenerations of the hip joint. In some

cases, sequels from an earlier polyarthritis, or cerebral haemorrhages, or thromboses, may complicate the valuation of the treatment of the fracture

It is also to be remembered that an impairment of the inward rotation, which is very often met with at the after-examination of these patients, may be caused by the compression of the back part of the femoral neck, and that a preservation of the resulting dislocation may be a qualification for osseous healing, the more necessary consolidation of the fracture thus being won at the price of a less necessary function. Usually, this impairment of the inward rotation does not very greatly inconvenience the patient.

A tabulation of results according to the movements in the hip joint does not seem to be of very great value but the following classification may give a general survey of restrictions to the different movements, in comparison with the other hip joint, according to an examination of my material more than two years after the operation. The measurements are made by eye without angle-meter and therefore do not claim any higher degree of exactitude.

*Restriction of movements at the last examination, more than 2 years after the operation*

Number of cases  
Degrees of restriction, in comparison with the other hip joint

	0°	0°— 10°	11°— 20°	21°— 30°	31°— 40°	41°— 50°	Over 50°	Not noted
Flexion active	23	5	8	3	1	1	1	9
passive	25	6	7	3	—	1	—	9
Extension active	38	1	—	2	—	—	—	10
passive	38	1	—	2	—	—	—	10
Abduction active	18	17	6	—	—	1	—	10
passive	13	20	5	3	—	1	—	9
Adduction active	23	15	3	1	—	—	—	9
passive	20	19	2	1	—	—	—	9
Rotation with ex- tended leg								
outward active	17	6	9	3	5	—	2	9
passive	17	7	8	3	4	—	3	9
inward active	19	9	6	5	—	1	1	10
passive	16	11	5	6	—	—	2	11
Rotation with 90° flexion								
outward active	17	9	7	3	2	1	—	12
passive	14	11	7	4	2	1	—	12
inward active	11	11	13	2	—	1	1	12
passive	10	11	8	8	1	—	1	12

In the table are not included 2 cases of ankylosis, 4 cases of pseudarthrosis followed up less than 2 years and 1 case of invalidity of the other hip joint after fracture of the femoral neck.



<i>Ability to walk</i>			No. of cases
1)	Able to walk without stick within fairly normal limits		
a)	without noteworthy inconvenience		25
b)	with some pains in the hip		1
2)	Able to walk with one stick		
	more than 300 m	less than 300 m	
a)	without pains in the hip	5	1
b)	with some pains in the hip	3	5
3)	Able to walk with two sticks		2
4)	Able to walk with crutches or wheeled crutches		7
5)	Unable to walk (including one case of pseudarthrosis followed up for less than 2 years)		3
			<hr/> 58 <sup>1</sup>

As a *summing-up valuation* — admittedly a very subjective one — I think the functional results may be classified as follows

Very good	25	} 34 = 58.6 %
Good	9	
Satisfactory	6	
Less good	6	
Bad	12	

#### Some special points of interest

##### *Postponed operation*

Usually, the operation has been carried out after 1—2 weeks of traction treatment. In one case the operation was postponed for 3 months on account of bronchitis and thyreotoxicosis. The nailing was carried out 9 days after a successful subtotal thyroidectomy, and the fracture healed perfectly in normal time and with excellent functional results.

##### *Penetration of nails in the hip joint*

In at least 16 or 17 cases, the femoral head was perforated during the operation, or in connection with secondary shortening of the femoral neck by impaction of the fragments in each other, or by bone resorption in the fracture region.

In two cases, it has been recorded that two nails were driven into the joint at the operation, but were immediately replaced by shorter nails. Certainly this has occurred in several other cases, though not noted in the operation records. Such a mishap, however, need not have unfavorable consequences for the prognosis. In one of the above-mentioned cases, a woman aged 70 the after

<sup>1</sup> All but 5 after examined at the hospital

examination showed no signs of arthritis (Fig. 13) and ideal function of the joint. In the other case, a woman of 52, where two nails, which had penetrated into the joint at the operation were immediately exchanged, a necrosis of the femoral head, it is true, was discovered after more than two years, when the fracture was healed, but it seems improbable that this complication had any connection with the technical misadventure at the operation.

Even if a perforating nail is *exchanged only after some time*, the results may be fully satisfactory, as in the following two cases.

1) Male, aged 80, op  $13/9$  1938. Roentgen  $11/10$  shows a penetration of two of the nails into the joint. Exchange of the nails  $17/10$   $13/4$  1943. Fracture healed with excellent function (Fig. 14).

2) Male, aged 73, op  $16/12$  1938. Roentgen  $20/1$  1939 on account of compression of the fracture region, one nail penetrated into the joint  $25/1$  1939 exchange of the penetrating nail. Pat. reports  $21/1$  1943 able to walk and move without inconvenience.

Besides the above-mentioned cases, an *exchange of nails* was carried out in one case on account of penetration (result obscured by polyarthritis), in two cases on account of impending penetration (in one of them an ankylosing arthritis developed after the exchange, and the nails were extracted, in the other, the femoral head was gradually pushed out from the acetabulum, probably by arthritic granulations) and in one case on account of dislocation in the fracture (result rather satisfactory).

*Extraction* of nails was carried out on account of *penetration* into the joint in 3 cases.

1) Woman, aged 72, op  $21/3$  1939. Penetration of nails observed  $17/5$ . Extraction  $22/5$ , inner fragment of a broken nail left in the femoral head. Arthrosis. Arthrodesis.

2) Woman, aged 66, op  $23/10$  1939. Necrosis of the femoral head, penetration by resorption of the head. Extraction  $8/5$  1940.

3) Male, aged 54, op  $3/1$  1940. Roentgen  $24/2$  one of the nails has penetrated more than  $1/2$  cm into the hip joint. Extraction of this nail  $19/3$  1940. Died of epilepsy  $7/11$  1942. Reported to have done his farm work just as well as before the hip accident.

### *Slipping out of the nails*

Rather often an insignificant protrusion of nails from the femoral shaft (up to 1 cm) has been observed. Such a small protrusion of a nail is, accordingly, not prevented by the blade at its outer end, evidently on account of the lack of resistance from the musculature (especially when not carefully sutured) or else because a collection of blood next to the bone gives a free space for the end

of the nail. Usually it is not a question of a slipping out of the nail from the femoral head, but a *protrusion of the outer end due to a shortening of the femoral neck* by impaction or bone resorption. In such an event, the nail can be said to have adjusted itself to the new conditions in a favourable way, the protrusion of the outer end, of course, being preferable to a penetration of the point into the joint.

However, in one case a real slipping out of the nails from the femoral head has been the obvious cause of a redislocation of the fracture. In four other cases, slipping out as well as breakage of nails had occurred when a pseudarthrosis was found to have developed. Either of these misadventures with the nails may be the primary cause of a redislocation. Thus the slipping out of a nail before healing leaves too heavy a load on the remaining ones which accordingly break, or breakage of a nail leads to a deterioration of the fixation, with movements between the fragments, which gradually expel the other nails from the femoral head.

I believe that the omission of the blade, as has been practised by some surgeons, is not advisable, since this accessory, though not absolutely preventing the slipping out of the nail, may be of some value for limiting the dangers of such a dislocation.

Slipping out of the nail led to extraction in two cases, 7 and 12 months, respectively, after the operation.

When only one nail is employed, for instance the three-flanged Smith-Petersen nail, it is not unusual to find it *working its way sideways or upwards through the femoral head*, thus giving rise to a dislocation leading to pseudarthrosis. Such a sideward movement of the nail has been observed in only one of my cases, an upward movement in none of them. This seems to give further proof of firmer fixation between the fragments by multiple nailing.

#### b Nailing with heavier, quadrangular nails, 97 cases

As mentioned above the common occurrence of breakage of the thinner triangular nails made it desirable to try stronger nails.

With the new quadrangular nails, 97 cases have been nailed up to May 1, 1944.

		Age										Total
		10—19	20—29	30—39	40—49	50—59	60—69	70—79	80—89	90		
Males			1	2	1	5		1	1		17	
Females	1				1	11	32	23	11	1	80	



Fig 6 Nails in good position



a



b

Fig 7 Redislocation due to breakage and slipping out of nails  
a) 3 $\frac{1}{2}$  months after the op b) 2 $\frac{1}{2}$  years after the op

NYSTROM Osteosynthesis of medial fractures of the femoral neck



a



b

Fig 8 Woman, aged 84 Only two nails

a) 7 months after the op No certain signs of necrosis

b) 4 years » » » Typical necrotic deformation of the head



a



b

Fig 9 Woman, aged 61

a) 5 1/2 months after the op Fracture seems to be healing

b) Nearly 1 years after the op Resorption of the necrotic head in progress



Fig 10 Woman, aged 66

- a) 4 months after the op 1 nail bent at the operation Relative density of the femoral head
- b) 10 months after the op 2 nails removed Incipient resorption of the femoral head Joint cartilage destroyed Redislocation

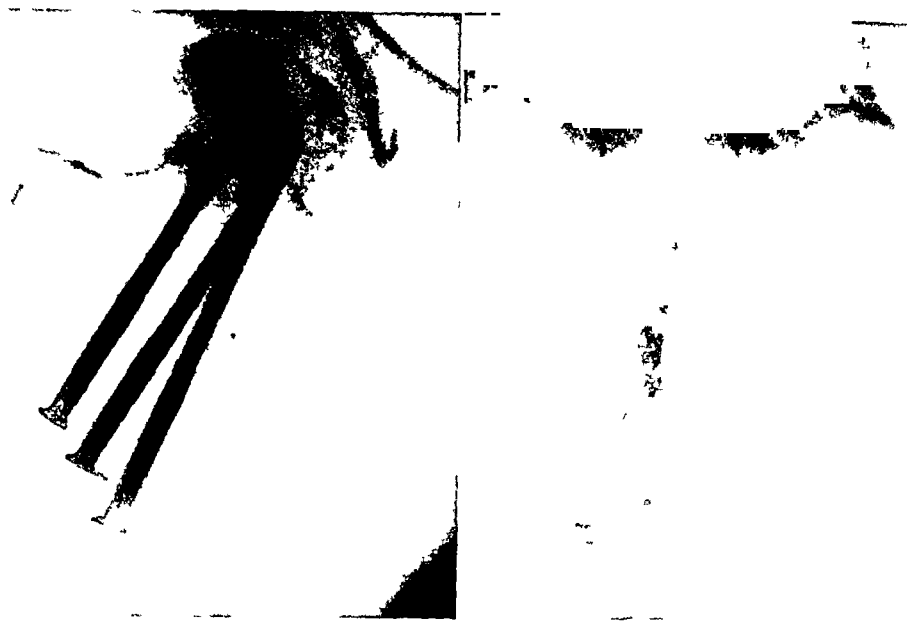


Fig 11 Woman, aged 52, lunatic, excitable Impacted adduction fracture in valgus position

a¹—12 4 months after the op All seems to be well Fracture healed  
 b) 2½ years • • • Femoral head necrotic in resorption Ossous healing



Fig 12 Male, aged 47

- a) 20 1/2 months after the op All well Osseous healing No sign of necrosis
- b) 2 years after the op Marked decalcification beneath the fovea Slight impression of upper surface of head Ordered not to put his weight on his leg  
Nails kept in their place till regeneration was thought to be sufficient, then extracted
- c) 3 years after the op , 13 months after first appearance of necrosis Impression of vertex still to be seen Able to walk with one stick without pain





Fig 13 Woman, aged 70 Nails penetrating into the hip joint at the operation, immediately extracted and exchanged More than two years after the op no signs of arthritis and function very good



Fig 14 Male aged 80 Nails penetrating into the hip joint, only exchanged 1 month after the op Fig shows condition 2 1/2 years after the op 1 years after the op still no signs of arthritis and excellent function



Fig 15 Woman, aged 66

a<sup>1</sup>—a<sup>2</sup>) 4½ months after the op , all well, osseous healing probably in progress  
 b) 2½ years after the op Top of femoral head depressed

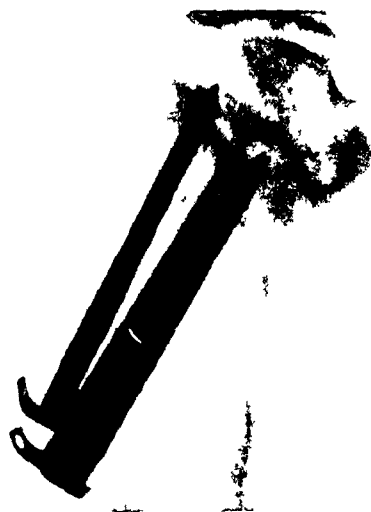
NYSTROM Osteosynthesis of medial fractures of the femoral neck



Fig 16 Woman, aged 69, lunatic  $2\frac{1}{2}$  years after the op concentric decrease of the head Two nails have perforated the head (The thud had been extracted earlier)



a



b

Fig 17 Woman, aged 65

- a) 3 months after op Reduction unsatisfactory
- b) 2 years after op Nails have slipped out Base of femoral head shortened (necrosis?) Fractural line still perceivable No arthritis Junction very good

Mortality during period of hospital stay 8 cases = 8.2 %

In spite of considerably extended indications for operative treatment (cf p 468), the mortality during the period of stay in hospital was not higher than in the earlier series

1932—1938, 95 cases nailed according to the Sven Johansson method mortality 8 %, 1938—1941, 79 cases of multiple nailing with thinner nails mortality 7.6 %

In May, 1944, 30 of these cases had been operated on more than 2 years before

4 of these had died in the hospital

		Age	Time of death after op	Cause of death
1	W	75	5 days	Arteriosclerosis Thrombosis cerebri
2	W	89	9 days	Pneumonia
3	M	82	1/2 month	Decubitus, Urinary infection Parotitis Pneumonia
4	W	71	2 months	Gangrene of lung

and 5 died within 2 years after discharge from the hospital

Patients alive followed up for more than 2 years.

Of the remaining 21 patients, all but one have been followed up and roentgenologically controlled more than 2 years after the operation. The not re-examined patient, a woman now aged 90, has been reported to be in good condition as far as the injured hip is concerned

Breakage or bending of nails has not been observed in any case.

#### Osseous union.

In none of the 20 roentgenologically controlled cases has a pseudarthrosis ensued. In two cases, however, there is still a line of resorption to be seen between the femoral head and the femoral neck, which makes it probable that complete osseous healing has not yet taken place (Figs 16 and 17), but no dislocation has occurred. In one of these cases, possibly in both of them, a necrosis of the femoral head has been responsible for the delayed healing.

#### Necrosis of the femoral head.

A patent necrosis of the head has occurred in two cases (10 %). In one of them the necrosis has been total, leading to a concentric

diminution of the head, causing the nails to perforate the head and to poke with their points into the roof of the acetabulum (Fig 16)

This case concerned a lunatic woman, aged 69, who was sent back to the asylum the day after the operation. She was reported to have disobeyedly stepped on her injured leg soon afterwards, and this might have contributed to the disturbance of the blood supply to the femoral head

In the other case, only the *top of the head* has undergone necrotic changes, manifested by a depression of the surface of some millimetres (Fig 15 b). Perhaps the impairment of the blood supply to this part of the head was caused by too tight a convergence of the nails towards the vicinity of the fovea and the entrance of the vessels from the ligamentum teres. But in another case with almost exactly the same position of the nails there are no signs of a change in the structure or the shape of the head

To the cases of necrosis of the head, we may possibly add one of the above-mentioned cases of delayed healing. Here, the height of the head has diminished by the resorption of its *base* (in the region of the fracture cleft), and the opposite part of the neck has broadened and become sclerotic, just as in the formation of pseudarthrosis (Fig 17). No signs of arthritis have appeared, and the function is very good. The reduction in this case having been less satisfactory, with a rather large remaining diastasis between the fragments, it seems to me to be possible that the resorption of the basal parts of the head was caused by the lack of contact with the other fragment, the blood supply being preserved

If this case also be counted as necrosis of the femoral head, the frequency of this complication rises to 15 %

*The results of the after-examination of the cases nailed with the heavier quadrangular nails seem to show that the increased calibre of the nails does not demonstrably increase the risk for necrosis of the femoral head*

#### Arthritis.

The two cases of patent necrosis of the femoral head show the usual accompanying signs of arthrosis (diminishing cartilage height). In the case of resorption of the basal part of the head, which might eventually be counted as a necrotic process, the joint seems to be quite uninvolved. In another case the cartilage height has diminished to  $\frac{1}{2}$  without evident cause. All the other cases which have been roentgenologically controlled after more than two years are without demonstrable signs of arthritic processes

Functional results

Restriction of movements at the last examination, more than 2 years after the operation

Number of cases

Degrees of restriction, in comparison with the other hip joint

	0°	0°-10°	11°-20°	21°-30°	31°-40°	51°-50°	over 50	Not noted
Flexion active	15	1	3			1		
passive	16	2	1	1				
Extension active	20							
passive	20							
Abduction active	8	2	4	6				
passive	10	1	4	5				
Adduction active	11	5	4					
passive	11	1	1		1			
Rotation with extended leg								
outward active	10	2	4	1	2	1		
passive	10	2	4	1	1	2		
inward active	11	2	2	1	2	1	1	
passive	11	2	3	1	1	1	1	
Rotation with 90° flexion								
outward active	9	1	5	2	2	1		
passive	9	3	3	2	2	1		
inward active	12	1	1	3	1	2		
passive	11	2	2	3		2		

Ability to walk

	No of cases	
1) Able to walk without stick within fairly normal limits		
a) without noteworthy inconvenience	12	
b) with some pains in the hip	2	
2) Able to walk with one stick		
a) without pains in the hip	more than 300 m	less than 300 m
b) with some pains in the hip	3	1
3) Able to walk with two sticks	1	1
4) Able to walk with crutches or wheeled crutches		
5) Unable to walk	1	

General evaluation of the results

Very good	13 } 16 = 80 %
Good	
Satisfactory	3 }
Less good	1
Bad	2
	1

### Some details

In two cases, one of the nails, and in one case, all of them have *slipped out* from the femoral head, without redislocation

*No nails have worked their way sideways or upwards through the femoral head*

Nails in bad positions (usually penetrating into the hip joint or threatening to penetrate) have been *exchanged* at a second intervention in 4 cases (result very good in 3 cases, satisfactory in 1 case)

Nails have been *removed*, in one case on account of penetration caused by a necrosis of the head, and in two cases, after healing of the fracture, on account of suppurating fistula and slight pains in the fracture region, respectively (very good result in both cases)

### Confinement to bed

With the three-flanged Smith-Petersen nail, we had the experience that if the patient was allowed to leave the bed too early (within a few weeks) there was grave risk of dislocation. We therefore kept the patients in bed for 2 months. Changing over to the multiple nailing, we maintained this rule during a first period of about 2 years, but then we gradually grew bolder. In the last few years, many patients have been allowed to sit up in a chair as early as *one to three weeks after the operation*. The firmer fixation obtained with the multiple nailing seems to make this concession admissible *as a rule*. Very old and feeble people have been placed in a chair the day after the operation in order to avoid the risk of thrombosis and lung complications.

### Extension of the indications for operative treatment.

The increasing confidence felt by the surgeons of the Clinic regarding the results to be expected from the method of treating medial fractures of the femoral neck, as described above, is evidenced by the *ever sinking frequency of non-operated cases*. During the period of operating according to the Sven Johansson method (1933—April 1938) 38.7 % of the cases admitted to the Clinic were excluded from operation. After the introduction of the procedure of multiple nailing, the corresponding numbers were

#### Non-operated cases

1938—1941	30.3 %
1912—May 1, 1914	13.9 %

As has been mentioned above, the mortality among the patients during their period of stay in the hospital has not increased. It

thus seems probable that the small danger of the operation is more than counterbalanced by the decrease in the risks of recumbency. The incomparable relief afforded to patient and nursing personnel alike by the simplified bedside treatment confers such benefit that, in an increasing number of cases, this has been thought to justify operative intervention, even if the patient's remaining span of life is estimated to be very limited.

### Summary.

Since 1938 osteosynthesis with the aid of three nails has been the common method of treating medial fractures of the femoral neck at the surgical clinic of the University of Uppsala. The armamentarium and its use are described. Thin triangular nails employed in a first series of 79 cases proved too weak. Therefore, in a later series of 97 cases, up to May 1st, 1944, considerably heavier quadrangular nails were used.

52 cases of the former series and 20 of the latter have been followed up and roentgenologically controlled for more than 2 years after the operation. In the former series (thinner nails) 7 cases of pseudarthrosis occurred, 5 of them being due to breakage of nails and two to the nails slipping out. In the latter series (heavier nails) no pseudarthrosis appeared.

Necrosis of the femoral head has occurred in a remarkably lower percentage than in LINTON's large series of Swedish cases treated according to Sven Johansson's method with a single three-flanged cannulated Smith-Petersen nail (published 1944). This difference, which has proved statistically significant, is considered by the author to be attributable to a firmer fixation and the consequently improved conditions for revascularization of the head produced by multiple nailing.

After introduction of the stronger nails, the patients' confinement to bed has been considerably shortened — they have usually been allowed to sit up in a chair 1—3 weeks after the operation. At the same time the indications for operative treatment have been extended, thus during the last two years only 13.9 % of the patients have been excluded from operation, in spite of this, there has been no increase in mortality among the operatively treated cases.



## Zusammenfassung

Seit 1938 ist die Osteosynthese mit drei Nageln in der chirurgischen Klinik der Universität Uppsala bei Behandlung medialer Brüche des Schenkelhalses die Normalmethode gewesen. Das Instrumentarium und seine Verwendung werden beschrieben. Dunne's dreieckige Nagel, die in einer früheren Reihe von 79 Fällen zur Verwendung kamen, erwiesen sich als zu schwach. In einer späteren Reihe von 97 Fällen (bis Mai 1944) wurden deshalb bedeutend stärkere, viereckige Nagel verwendet.

52 Fälle der ersten Reihe und 20 Fälle der späteren wurden mehr als 2 Jahre nach der Operation nachuntersucht und röntgenologisch kontrolliert. In der ersten Reihe (mit schwächeren Nageln) kamen 7 Fälle von Pseudarthrose vor, von denen 5 durch Bruch der Nagel und 2 durch Herausgleiten derselben bedingt waren. In der späteren Reihe (mit stärkeren Nageln) war kein Fall von Pseudarthrose vorgekommen.

Nekrose des Femurkopfes ist auffallend seltener vorgekommen als in LINNOR's grosser Serie schwedischer Fälle (1944 veröffentlicht), die nach der Methode von Sven Johansson mit einem einfachen, dreigezackten, kanalisierten Smith-Petersen-Nagel behandelt waren. Dieser statistisch gesicherte Unterschied hängt, meint Verf., mit der besseren Fixation der Bruchstücke aneinander und den dadurch gegebenen besseren Bedingungen für die Revaskularisation des Femurkopfes bei der multiplen Nagelung zusammen.

Nach Einführung der stärkeren Nagel konnte die Bettruhe für die Kranken bedeutend abgekürzt werden — sie haben zu meist 1—3 Wochen nach der Operation aufsitzen dürfen. Gleichzeitig sind die Operationsindikationen umfassender geworden. In den letzten zwei Jahren sind nur 13,9 % der Patienten von der Operation ausgeschlossen worden, und zwar ohne Zunahme der Sterblichkeit unter den Operierten.

## Résumé.

Dès 1938 ostéosynthèse avec 3 clous a été la méthode normale du traitement des fractures médiales du col fémoral à la clinique d'Uppsala. Les instruments et leur emploi sont décrits.

Des clous minces triangulaires, employés dans une première série de 79 cas, se sont montrés trop faibles. Par conséquent, dans une seconde série de 97 cas, (jusqu'au mois de Mai 1944), des clous quadrangulaires considérablement plus forts ont été employés. 52 cas de la première série et 20 cas de la seconde ont été réexaminés et contrôlés par roentgen plus de 2 ans après l'opération. Dans la première série (avec des clous faibles) 7 cas de pseudarthrose sont survenus, dont 5 étaient dus à fracture des clous et 2 de glissement des clous. Dans la seconde série (avec des clous forts) il n'y avait pas un seul cas de pseudarthrose. Nécrose de la tête fémorale a été manifestement moins fréquente que dans la grande série de LINTON des cas suédois traités selon la méthode de Sven Johansson (publiée 1944). L'auteur considère que cette différence, confirmée par examen statistique est en relation avec une fixation plus forte des fragments l'un à l'autre et, par ceci, des conditions meilleures pour revascularisation de la tête au clouage multiple. Après l'introduction des clous forts l'alitement des malades a été considérablement abrégé — ils ont habituellement pu sortir du lit 1 à 3 semaines après l'opération. En même temps, les indications d'opération ont été étendues; pendant les 2 dernières années seulement 13.9 pourcent des malades a été exclu de l'opération, sans augmentation de la mortalité des opérés.

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From the Surgical Clinic of the Karolinska Sjukhuset  
(Professor JOHN HELLSTROM, M D, Surgeon-in-Chief)  
and the Department of Pathology, Sodersjukhuset  
(Dr FREDRIK WAHLGREN, Pathologist in Chief)

## Hyperparathyroidism. Clinical and Pathologic Observations of 12 Cases.

By

JOHN HELLSTROM and FREDRIK WAHLGREN

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### Introduction.

Concerning hyperparathyroidism we are still faced with several unsolved problems although a large number of cases have been subjected to a thorough clinical analysis. It has been established that hyperparathyroidism is an endocrine disease, in which the hyperfunction of the parathyroid glands plays an essential part in and which disorders in the calcium metabolism produce the most important clinical symptoms, but even so the cause of the hyperfunction of the parathyroids is still unknown and so is the exact nature of the parathyroid changes in hyperparathyroidism. Although a number of circumstances indicate that pluriglandular disorders are present, the connection between these disorders is still unknown and so is the relationship between the parathyroid hyperfunction and the kidney lesions. This relationship is of the greatest interest because undoubtedly the kidney changes are of the first importance to the prognosis and their presence greatly diminishes the chance of a successful result even in cases where the hyperparathyroidism has been abolished by a successful parathyroidectomy. This operation has been performed in a large number of cases reported in literature, thus rendering it possible to make a statement about the prognosis after a parathyroidectomy. But even so, most of the cases reported have only been followed up for a comparatively short time after the operation and consequently do not permit an exact

judgement of the prognosis for very far ahead For this reason reports of cases of hyperparathyroidism are still desirable, especially when they have been followed up for a long time

12 verified cases of hyperparathyroidism are dealt with below, 11 of these were subjected to a parathyroidectomy In all the cases reported, one of us (HELLSTROM) performed the clinical examinations and the operations, while the other (WAHLGREN) made the histologic examinations The present article has consequently been divided into a clinical and a pathological part

### Part I. Clinical.

The material dealt with below comprises 12 cases, collected during the years 1930 to 1944 at our surgical clinic, 6 of them dating back to the time when this clinic was a department of the Maria hospital, whereas the remaining 6 cases were collected after the removal of this department to the Karolinska hospital Five of the cases have previously been reported (HELLSTROM) Six of the patients came from Stockholm and six from the provinces Some of the most important clinical symptoms recorded before and after the operation are related in tables 1 and 2 All the patients were women The youngest of the patients was 29 years of age at the time of the operation The others were between 42 and 62 years of age In most of the cases, however, symptoms of hyperparathyroidism could be traced back for many years before the admission The symptoms will not be discussed in detail as they present nothing of interest beyond what has previously been described viz fatigue, loss of weight, anaemia, general weakness, headache, pains in the bones, joints and muscles, spontaneous fractures, poor appetite, vomiting, constipation, symptoms of cystitis and pyelitis, attacks of renal colics, polyuria, palpitations of the heart, shortness of breath etc It should be noted that a tumor in the upper jaw in three of the cases was one of the early symptoms It is difficult to ascertain whether the above-mentioned symptoms were due to the hyperparathyroidism in all the cases as most of them are not pathognomonic of the disease Possibly some of the symptoms may have been due to disorders which were of importance for the etiology of the hyperparathyroidism We shall return to this subject when discussing the etiology

Table

Case No	Before the operation											
	Sex	Age	Ost fibr gen	Kid-ney calci fications	Kid-ney concre ments	Hyper tonia	Albu min uria	Infec- tion in the urinary passages	Blood cal- cium mg	Serum Phos phorus mg	Urin Cal cium mg per day	Phos pha tase units
1	F	42	+	—	—		+	(—)	16 0			
2	"	44	+	+	—		+	+	15 7	3 0	102	
3	"	45	+	—	+	—	—	—	17 7	2 2	365	
4	"	42	+	+	—	—	+	+	15 7	2 0		
5	"	60	—	—	+	+	+	+	15 1	2 2	390	
6	"	49	—	+	+	+	—	+	15 1	3 9	370	6
7	"	62	—	+	+	+	+	+	16 2	5 3	350	9
8	"	59	+	+	+	+	+	+	14 0	5 0	230	9 5
9	"	29	+	+	—	—	+	+	17 5	6 5	386	24
10	"	49	+	—	—	+	—	+	16 2	2 0	860	61
11	"	55	—	—	—	+	+	+	14 7	2 9	182	> 90
12	"	54	+	+	+		+	+	14 0	4 0		

In all the cases the laboratory examinations revealed a considerable hypercalcemia. The serum phosphorus was more variable, ranging between 2 and 6.5 mg per hundred cubic centimeters. The urinary calcium which was examined in 9 of the cases showed clearly raised values in 6 of them. The phosphatase measured in 6 cases, was moderately raised in three of them and considerably raised in the others. Nr 10 is a very characteristic case in respect of calcium and phosphorus metabolism, exhibiting the following values:

	Before the operation	After the operation
Blood calcium	16.2 mg	9.8 mg
Blood phosphorus	2.0 mg	3.6 mg
Urinary calcium	860 mg per day output	30 mg per day output
Phosphatase	61 units	28 units

Changes in the skeleton, i. e. *ostitis fibrosa generalisata* were present in 8 cases and a diffuse osteoporosis in one, i. e. case nr 11. X-ray photographs of the remaining 3 cases revealed no osseous lesions.

Calcifications in the kidneys, in some cases actual concretions, were observed in 8 patients.

On the basis of the occurrence of osseous changes and renal calcifications the cases may be divided into three groups:

1

After the operation							
Observation period in years	General condition	Blood calcium mg	New bone lesions	Renal calcifications	Hypertonia	Albuminuria	Infection in the urinary passages
13	healthy	11.8	—	—	—	+	—
12	dead	12.3	+	increase	+	+	+
10	healthy	10.0	—	—	+	+	—
7	dead	9.1	—	decrease	+	+	—
5	healthy	13.5	—	unchanged	+	+	+
4	improved	12.2	—	increase	+	(—)	+
3	»	10.8	—	decrease	+	+	+
3	»	9.3	—	unchanged	+	+	+
2	»	8.7	—	decrease	—	+	+
2/12	»	9.0	—	—	+	+	—
6/12	»	9.0	—	—	+	+	+
Not operated on							

Osseous changes and renal calcifications 5 cases

Osseous changes but no renal calcifications 4 cases

Renal calcifications but no osseous changes 3 cases

Albuminuria was observed in 10 cases and infection in the urinary passages in 9. It is noteworthy, that in some cases, the albuminuria alternated with albumin-free periods.

In 9 of the cases full details were available as regards the blood pressure before the parathyroidectomy, in six of these nine cases the blood pressure was increased, whereas it was normal in the remaining 3. The blood pressure may apparently vary considerably in one and the same patient. In case 7 e. g. the blood pressure was 210 systolic and 120 diastolic at the time of the admission, but during the stay in the hospital it dropped to 125 and 120, respectively. In case 4 the blood pressure was 120 systolic and 80 diastolic. Shortly before the operation a hypertonia had been observed.

### Kidney Injuries in Hyperparathyroidism.

Among the morbid changes caused by hyperparathyroidism special attention will in the following be given to the kidney lesions.

Undoubtedly these lesions constitute one of the most impor-

Table 2

Case No	Before the operation			After the operation							
	N	P	N	Filtration (Creatinine)	Specific gravity	N	P	N	Filtration	Specific gravity	Time after operation
1						37					8 yrs
2						55-47	31-40		1 008-1 010		5 yrs
						212					12 yrs
3						36			1 002-1 021		8 yrs
4	40		70	1 005-1 010		40	47				3 yrs
5	34		71			35					5 yrs
6	38					40	67-73				4 yrs
7	41-51			1 008-1 016		54					3 yrs
8	63		7	1 002-1 009		43	14		1 002-1 008		3 mons after 1st op
							44		1 002-1 008		4 mos af
							29		1 003-1 009		2 yrs after 2nd op
						54	47		1 009-1 009		3 yrs af
											ter 2nd op
9	30			1 005-1 009		50			1 001-1 010		6 weeks
						36	76		1 002-1 009		1 mons
						31	(205)		1 012-1 013		2 yrs
10	34		72	1 003-1 010		29	73		1 001-1 016		2 mons
11	43-70		47	1 009-1 011		60	34		1 003-1 010		6 mons

tant symptoms of the hyperparathyroidism and are of the greatest importance for the prognosis as well as for the etiology. The kidney lesions may be divided into three main groups

- 1 Noninflammatory parenchymal lesions
- 2 Infectious inflammatory changes
- 3 Formation of concretions

Changes of the three above mentioned types may be found co-existing particularly in advanced cases and especially in cases in which the patients died of uremia. It may consequently be difficult to determine which of the changes were primary and which were secondary. In early cases it is easier to arrive at a conclusion on this point, but it is only possible to make a pathologic examination of the kidneys in a few of them. It is therefore necessary to resort to clinical examinations of the urine and kidney functions and to X-ray examinations.

I In cases of hyperparathyroidism it is generally assumed

<sup>1</sup> First test

that the tubules are probably damaged by the precipitation of calcium occurring when the most calcium containing ultrafiltrate is concentrated in the capsular space. In support of this assumption it has been pointed out (HOLTEN and others) that the capacity of concentration in the kidneys is reduced in cases of hyperparathyroidism, the filtration remaining comparatively satisfactory whereas in cases of ordinary nephritis these two partial functions are about equally reduced.

Undoubtedly cases nos 4 and 10 strongly indicate that the tubular function is more impaired than that of the glomeruli, these cases presented a filtration of about 70 coinciding with a specific gravity of a maximum of 1.010. Case 9 and especially case 8, however, indicate that the glomeruli function may also be greatly reduced. In the former case the filtration was 50, in the latter it was only 7.

It is, of course, of the greatest importance to ascertain how far this functional disorder implies any manifest cellular injury. To some extent this may be settled after a successful parathyroidectomy abolishing the hyperparathyroidism and causing a disappearance of the calcium contents in the ultrafiltrate. It should be noted that the glomerular function improved considerably after the operation in the two last-mentioned cases, whereas the tubular function remained more or less unchanged. At least in the early cases the glomerular lesions seem to be functional and reversible, whereas the tubular lesions are more manifest. In case 10, however, even the tubular function seemed to improve after the parathyroidectomy, as the results after water test improved from 1.003—1.010 before the operation to 1.001—1.016 after it. In the later stages manifest glomerular injuries as well as interstitial nephritis seem to be present.

II. An infection in the urinary passages is frequently met with in hyperparathyroidism and a progressing pyelonephrosis often seems to be the cause of the final uremic stage. This type of infection was noted in 9 of our cases. In 2 cases no bacteria were present, but an abundance of pus cells in the urine indicated an infection. In one case only, no 3, no infection was demonstrated. The infection in the urinary passages is probably secondary to the noninfectious kidney changes and especially to the tubular lesions. This same infection may also antecede the hyperparathyroidism. Thus in case 7 the patient presented symptoms of a cystitis more than 40 years before the hyperparathyroidism.



was diagnosed, another patient, case 6, presented these symptoms 20 years before any hyperparathyroidism was demonstrated. As an infection in the urinary passages especially in women, is frequently met with, the coincidence of both diseases in the same patient easily occurs. This does not exclude their having a deleterious effect on each other.

III Renal concretions are frequently met with in hyperparathyroidism, the formation of such concretions is of course connected with the increased excretion of calcium through the kidneys. A distinction should, however, be made between calcifications in the parenchyma and real concretions in the kidney pelvis. The relations between these two processes in our material were as follows:

Neither calcifications nor concretions	3
Calcifications and concretions	3
Calcifications but no concretions	1
Concretions but no calcifications	2

It is probable that concretions arise through parenchymal calcifications having made their way into the kidney pelvis continuing to grow there. The high content of calcium in the urine in some cases in connection with other conditions favouring lithiasis, i. e. infection and stasis, may also be the cause of the development of concretions in the kidney pelvis itself. In some cases the concretions may have no relation to the hyperparathyroidism. In case 3, e. g. a ureteral stone passed naturally one year before the occurrence of any symptom of hyperparathyroidism and no concretions were observed during the four years which passed before a parathyroidectomy was performed. In case 6 a pyelolithotomy was performed in 1924 in order to remove a typical staphylococcal concretion and at that time no clinical symptoms of hyperparathyroidism were present. During the following years symptoms of concretions appeared on both sides and a nephrectomy was performed on the right side in 1928. In 1939 a hypercalcemia and extensive parenchymal calcifications were observed in the remaining kidney.

Further the renal concretions may produce changes such as total or partial hydronephrosis coupled with parenchymal atrophy, thus aggravating the kidney lesion and the reduction of the functioning which are due to the precipitation of calcium.

## The Etiology of the Parathyroid Hyperfunction

An enlargement of one or several parathyroid glands is regularly observed in cases of hyperparathyroidism, although the theoretical possibility of a hyperfunction of non enlarged parathyroid glands must be admitted. No one opinion has been reached as to the reason for the hypertrophy and the hyperfunction of the glands. Various possibilities are conceivable.

Undoubtedly the so called compensatory hypertrophy of the parathyroids occurs in diseases with a tendency to a reduced blood calcium value on account of a poor resorption of calcium from the intestine, increased consumption of calcium or to an abnormal composition of the blood plasma. This applies chiefly to two morbid conditions: i. e. D-avitaminosis and certain kinds of nephritis. Unlike hyperparathyroidism these conditions do not present an increase of the blood calcium, which is normal or even below the normal. The existence of a parathyroid hyperfunction is demonstrated by the increased content of parathyroid hormone in the blood (HAMILTON & HIGHMAN).

BERGSTRAND and others have demonstrated that a nephritis may be accompanied by a considerable hyperplasia of the parathyroids. HAMILTON & HIGHMAN observed an increase in the parathyroid hormone in 20 out of 23 cases of nephritis. A similar increase was demonstrated by experiments with dogs in which renal insufficiency had been produced by the removal of one and a half kidney. It has been asserted that it is mainly the retention of phosphate which stimulates the parathyroids to hyperfunction in cases of nephritis. The fact that a parathyroid hyperplasia may be produced in rabbits by large intramuscular or intravenous injections of phosphate seems to support this assumption (DRAKE, ALBRIGHT and CASTLEMAN). It is supposed that the parathyroids start a hyperfunction in order to counteract a fall in the blood calcium value caused by the retention of non-organic phosphorus. As first shown by ERDHEIM a parathyroid hypertrophy and an increased parathyroid hormone content in the blood are frequently met with in rickets (HAMILTON and others). Several authors (HIGGINS, SCHEARD & WILDER—ZUKSCHWERDT—NIELSEN & STEFFENSEN) emphasize that the deficiency in vitamin D results in a hyperfunction and a hypertrophy of the parathyroids. The hypertrophy may either be diffuse or, according to WILDER

and others it may under certain circumstances, e g the presence of certain embryonal cells, be adenomatous. The compensatory and beneficial hypertrophy may, however, develop immoderately thus causing an unchecked production of parathyroid hormones. The cause of this over-compensation has not been ascertained, but it may be influenced by other superior endocrine glands, particularly the hypophysis. This influence may either be caused by an elimination of the restraining effect of the hypophysis, (ZUKSCHWERDT) or the hypophysis may directly stimulate the parathyroids. The enlargement of the hypophysis, frequently observed in patients who died of hyperparathyroidism, supports this theory. The fact that most of the published cases of hyperparathyroidism come from countries with a deficiency of ultra-violet light and vitamin D supports the hypothesis that hyperparathyroidism is due to an over-compensation caused by disorders in the calcium metabolism (WILDER & HOWELL and others). The comparatively frequent occurrence of hyperparathyroidism in Denmark may — according to NIELSEN & STELLINGSMA — be explained by the deficiency in calcium and vitamin D which, as demonstrated by MEULINGRACHT, is a characteristic of the ordinary diet in that country.

By an analysis of the above mentioned etiologic factors in our material the following results are obtained. As previously mentioned, some kind of kidney lesion occurred in practically all the cases. The question then arises whether the nature of these lesions or the time for their occurrence, indicate that they might have produced a compensatory parathyroid hyperplasia, leading to an unchecked hyperfunction. It is, however, impossible to answer this question with full certainty. It is only possible to ascertain that in certain cases the above mentioned facts tend to indicate that the kidney lesion may be primary, and of etiologic significance to the hyperparathyroidism, whereas in other cases the same facts suggest the opposite conclusion. The cases in which a kidney disease was present long before the hyperparathyroidism symptoms, have all been cases of pyelitis and pyelonephritis with no increase of the non protein nitrogen, consequently they did not belong to the type of kidney lesion which has generally been believed to favour the development of a compensatory parathyroid hyperplasia. At least in one case (nr 3) no symptoms of kidney lesions were observed in spite of the presence of a pronounced hyperparathyroidism. To sum up it may

be said that the kidney lesions observed in our cases were probably the consequence and not the cause of the hyperparathyroidism

Endocrine disorders were found by autopsy of two patients who died of uremia, morbid changes were observed in several endocrine glands with an enlargement of the hypophysis calling for special attention. As our patients were all women, the possibility of an etiologic significance of disorders in the female sex hormones presents itself. WILTON is of the opinion that the course of the disease and the autopsy findings in our case 12, indicate that the climacterium elicited an endocrine disorder along with a hyperparathyroidism and an *otitis fibrosa generalisata*. It cannot be denied that the development of the hyperparathyroidism coincided with the climacterium in some cases, but in others — many of which have been reported in literature — the hyperparathyroidism developed at a far earlier stage. Six of four patients were nulliparas, whereas the others were 1—4 paras. Painful and irregular menstruation was noted in one case, painful and copious menstruation in another. On her admission one of our patients was in the fourth month of pregnancy. She had, however, had four deliveries previously, and at the time of the admission the osseous lesions were so far advanced that the hyperparathyroidism must probably have developed before the last pregnancy. Number 11 was a case of a marked hyperthyroidism with a standard metabolism of  $+55$ . In case 2 the standard metabolism was  $+9$  before the operation,  $-22$  three weeks later and  $-1$  four months after the operation. In case 7 the standard metabolism was  $+13$ , this patient also suffered from diabetes. On the other hand the standard metabolism in case 8 was  $\pm 0$ , in case 9  $+1$ , in case 10  $+2$  and in case 4—13. Consequently, our material does not prove any specific connection between the thyroid and the parathyroid functions. Neither any connection observed between the parathyroid function and the size of the thyroid, this being normal in 2 cases, reduced in 5, and increased in 3.

Thus, our material does not indicate that endocrine disorders should play any rôle for the onset of the hyperparathyroidism. As regards the pluriglandular disorders observed in the two autopsied cases it is impossible to decide about their interrelation, even if the possibility of the hypophysial changes being primary in relation to the parathyroid hyperplasia cannot be denied.

It is not possible to ascertain if the D-avitaminosis and the deficiency of calcium in our cases have caused a hyperparathyroidism through a stage of a compensatory parathyroid hyperfunction. Six of the patients had a frail physique and suffered from general weakness, they may consequently have suffered from a deficiency disease. The six other patients, however, did not exhibit any such symptoms.

### § The Prognosis after Parathyroidectomy.

According to the experiences hitherto achieved the prognosis is bad in non-operated cases of hyperparathyroidism as, sooner or later, most patients die of a renal insufficiency or of other complications. Although exceptional cases showing a temporary improvement, or even a permanent disappearance of the hyperparathyroidism, are known. On the other hand a large number of cases have shown that the removal of one or more hyperfunctioning parathyroid glands may bring about the immediate disappearance of the hyperparathyroidism and a considerable improvement or even a disappearance of its various symptoms. In some cases, however, no complete recovery is obtained, in other cases a temporary improvement is followed by a deterioration. Various causes may be given for these failures which have not been adequately accounted for as the literature only contains a comparatively small number of cases of hyperparathyroidism with a satisfactory post-operative period of observation.

11 of our patients were submitted to a parathyroidectomy. In seven of these cases only one enlarged gland was removed, in the other 4 cases two glands were removed. In the first mentioned 7 cases only the removed gland was decidedly enlarged, in one of these, viz. case 10, one more gland may possibly be said to be hypertrophied. The disappearance of the hypercalcemia was the immediate result achieved in these 7 cases.

One case, nr 5, presented a gland  $37 \times 18 \times 12$  mm in addition to two glands slightly larger than a broad-bean. One of these as well as the large gland were removed. Even in this case the blood calcium value dropped rapidly to the normal level. One case, nr 8, presented two distinctly enlarged glands, one of which was nearly as big as a hen's egg, while the other was as big as the tip of a thumb. Only one of the glands was removed at the first stage of the operation on account of the risk of tetany,

the blood calcium value then dropped to 11.0 mg % Two and a half months later when the blood calcium had risen to 11.7 mg% the other enlarged gland was removed causing a fall in the blood calcium to normal values In case two only the right side of the neck was exposed at the first operation and a parathyroid gland, almost the size of a hen's egg, was removed The calcium content in the blood dropped to a minimum of 12.6 mg% only to rise in a comparatively short time to the same high level as before the operation When another operation with a complete exposure of the neck organs was performed four months later, another greatly enlarged parathyroid gland was discovered and removed and the blood calcium dropped to normal values

Finally, in case six a parathyroid gland 5 mm by 20 was removed at the first operation The blood calcium value ranged between 15.8 and 15.3 mg% before the operation, nine days after the operation it was 15.1 mg% and twenty days later 17.0 mg%, four years later the calcium content in the blood was 15.4 mg% A new operation revealed a parathyroid gland the size of the tip of a forefinger, situated at the same place as at the previous operation The operation had no immediate effect on the blood calcium value which at first remained at the same level as before the operation Six months later, however, the blood calcium value had dropped considerably, although still abnormally high

In the ten cases where the blood calcium returned to a normal level after the operation, the patient's condition also improved greatly, the bones becoming recalcified and the calcium excretion in the urine decreasing greatly

The *subsequent* course is of the greatest interest Three patients felt completely well 13, 10 and 5 years respectively after the operation Five "improved considerably" and one was merely designated as "improved" Two patients died but a considerable improvement was noted, 12 and 5 years respectively after the operation

The most important symptoms showed the following conditions

The *blood calcium* value was normal in 7 cases, slightly raised in 3, and considerably raised in one case The phosphatase value was very high in two cases, in one of these it dropped from 61 to 28, in the other from  $> 90$  to 17

A recalcification occurred in all the cases showing an *ostitis fibrosa generalisata* previous to the operation, in case 2, however,

a destruction had occurred in other parts of the skeleton which parts presented a normal picture before the operation

The renal calcifications had increased in one case (2), decreased in 3 (4, 7 and 9) and remained unchanged in 2 (5 and 8) No calcifications or concretions had turned up in any of the cases in which they were not present before the operation

Infections in the urinary passages persisted in all the cases in which they were present before the operation

Albuminuria was also present in all the cases in which this symptom had been observed previous to the operation, in addition it was present in one case, nr 3, in which the urine did not contain albumin at the time of the operation

The blood pressure was highly raised in the two mortal cases, in one case rising from 120 to 220 It is noteworthy that a similar rise occurred in further two cases, numbers 3 and 8, the former even presented an albuminuria

The kidney function (table 2) In case 2 the renal insufficiency progressed and the patient died of uremia 12 years after the operation One patient, case 4, died 7 years after the operation, the cause of the death probably being uremia In case 7 the nonprotein nitrogen was higher three years after the operation than previous to it In case 11 the non protein nitrogen was also higher 6 months after the operation than previously, and the filtration was worse in spite of a normal blood calcium value, an improvement in the general condition and an increase of the calcium in the bones In case 8 the filtration improved after the operation but the reduced concentrating ability remained unchanged After the second operation the filtration improved considerably, and this improvement persisted at the re-examination 3 years later

In case 9 the filtration improved after the parathyroidectomy and so did the concentrating ability, though to a lesser degree In case 10 the concentrating ability, i. e. the tubular function improved considerably

To summarize, it may be said that the prognosis after the parathyroidectomy for hyperparathyroidism is in the first place dependent on whether the operation has abolished the hyperfunction of the parathyroids and further on the amount of damage caused in the vital organs by the hyperparathyroidism

It is easy to cure the hyperparathyroidism completely by a parathyroidectomy if the disease is confined to one parathyroid gland only greater difficulties arise if more than one gland is

overactive or if the affected gland is situated at an abnormal place, e g in the mediastinum. The enlarged gland disclosed at the operation may not necessarily be the actual cause of the hyperparathyroidism. This fact increases the difficulties as shown in one of our cases (nr 6). In this case an enlarged parathyroid gland was removed in 1939 but nevertheless the blood calcium values did not decrease. Nor did the blood calcium values decrease immediately after the second operation in 1943, but a distinct drop was noted 6 months later, even if the level was still considerably above the normal. The condition of the blood calcium after the parathyroidectomy seems in this case to be that the hyperfunctioning gland which maintains the hyperparathyroidism must be situated in another place, probably in the mediastinum. It is further possible that a true relapse appears even if the hyperparathyroidism is cured completely by the operation. In case 2 we are met with a true relapse in which the blood calcium values rose again after having been normal for some time, new bone lesions developed and a mortal uremia set in. Even if the primary cause of the hyperparathyroidism is not yet known it is possible to say that in this disease as in many others i e renal lithiasis, we are faced with two different types. In one type the over-activity of one or more parathyroid glands is maintained by the hyperparathyroidism even when the actual cause of the hyperfunction has disappeared. In the other type the real cause remains, leading to a hypertrophy and a hyperfunction of the glands left at the parathyroidectomy. In the former type the hyperparathyroidism vanishes after the parathyroidectomy, in the latter a relapse occurs.

The other factor decisive for the prognosis is the extent of the damage caused by the hyperparathyroidism in the vital organs before the operation is performed, and in this connection the most pronounced clinical symptoms, e g the osseous lesions are not always the most important. Even a severe *ostitis fibrosa generalisata* may heal almost completely. The most important factor for the prognosis is undoubtedly the kidney lesions. As previously mentioned, different kinds of these lesions are met with viz, nephritic, (especially tubular) infectious pyelonephritic and calculous diseases. Even if a cessation of the abnormally great calcium excretion through the kidneys may lead to a quiescence or in certain cases even to an improvement in the renal lesions, these seem, in most cases, to persist or frequently even to pro-



gress The kidney lesions may also have a stimulating effect on the remaining parathyroid glands leading to a compensatory or — in certain cases — even to an overcompensatory hyperfunction, thus starting a vicious circle DOWNS & SCOTT have described a case of hyperparathyroidism in which the patient died of renal insufficiency and in which one of the parathyroid glands showed an adenoma, the others a diffuse hyperplasia The authors concluded that the parathyroid adenoma was primary, leading to the kidney changes which further caused the hypertrophy of the other parathyroid glands Our case nr 2 is of interest in this connection, as the autopsy revealed two hypertrophic parathyroid glands which were not present at the operation twelve years before

### Treatment.

The experiences gained from our own cases as well as from the many cases reported in literature show that a parathyroidectomy may bring about an immediate relief in the hyperparathyroidism restoring the health and working capacity of these often greatly invalided patients To obtain this result it is, however, necessary to remove the hyperfunctioning parathyroid tissue in such amounts that a hyperproduction of the parathyroid hormone ceases This result is not obtained by the removal of one hypertrophic gland, it is necessary to look for and remove other enlarged glands For this reason the patients should be kept under constant observation and the parathyroid glands examined by means of a renewed operation if the hyperparathyroidism does not disappear or if it recurs Even if it is impossible to influence the primary cause of the hyperparathyroidism, we can treat the parathyroids, which are probably the most important link in the chain of causes and thereby keep the calcium metabolism within normal limits for the longest possible time It is also important that the parathyroidectomy is performed at the earliest possible stage, before the kidneys have suffered irreparable damage This calls for exact observation of the many various symptoms which the hyperparathyroidism may present and also for more general use of laboratory examinations, especially determinations of the blood calcium

## Part II. Pathology.

The pathologic observations in the material here mentioned, comprise parathyroid glands removed at operations and two autopsied cases. The other post mortem observations have not been available and they will be dealt with by other authors. One patient who died was not submitted to an autopsy.

Attempts have been made to determine whether any histologic difference exists between the parathyroid glands in the different cases and, if so, to find out whether their difference has any relation to differences in the clinical pictures. Attempts were also made to decide if the pathologic appearance of the glands permitted any conclusions regarding the pathogenesis of the hyperparathyroidism.

Table 3 gives a summary of the most important pathologic facts of the different cases. Only in one case (2) all the parathyroid glands were submitted to a histological examination, as seen from table 3. In most of the other cases, however, all the parathyroid glands were exposed and inspected at the operation. The glands not removed appeared microscopically normal, but this fact does not exclude that histological changes may have been present.

Table 3.

Case No	Parathyroids removed at the first operation	Parathyroids removed at the second operation	Parathyroids seen at autopsy	Number of histologically examined parathyroids	Summary of histologic picture
1	1 about size of hazel nut	—	—	1	Solitary adenoma composed of enlarged chief cells. Remains of adult glandular tissue.
2	1 about egg sized	1 size of large large walnut	2 about walnut sized	4	Two glands operationally removed nodose structure, water clear cells. Two glands removed at autopsy nodose structure with adenoma of different cell types.
3	1 about walnut sized	—	—	1	Solitary adenoma composed of enlarged chief cells. Remains of adult glandular tissue.

Case No	Parathyroids removed at the first operation	Parathyroids removed at the second operation	Parathyroids seen at autopsy	Number of histologically examined parathyroids	Summary of histologic picture
4	1 barely the size of an almond	—	?	1	Nodular structure with nodules composed of atypical chief cells Remains of adult glandular tissue
5	1 about 37 by 18 by 12 mm 1 size of brown bean	—	—	2	Both glands showed same diffuse structure Tissue composed of large water clear cells
6	1 about 5 by 20 mm	1 about size of finger tip	—	1	Suggestion of lobation Tissue composed entirely of water clear cells
7	1 about size of hazel nut	—	—	1	Diffuse structure Tissue composed of water clear cells
8	1 about egg sized	1 about size of thumb tip	—	2	Both glands showed same picture No dose structure, but tissue composed mainly of water clear cells
9	1 about size of hazel nut	—	—	1	Nodular structure Some lobes made up of small atypical chief cells, others of water clear cells Remains of adult glandular tissue
10	1 nearly plum sized	—	—	1	Nodular structure Some lobes made up of large chief cells, others of small, atypical chief cells Remains of adult glandular tissue
11	1 about size of hazel nut	—	—	1	Solitary adenoma composed of small atypical chief cells
12	not operated	—	1 about plum sized Others?	1	Nodular structure Composed of typical chief cells Remains of adult glandular tissue

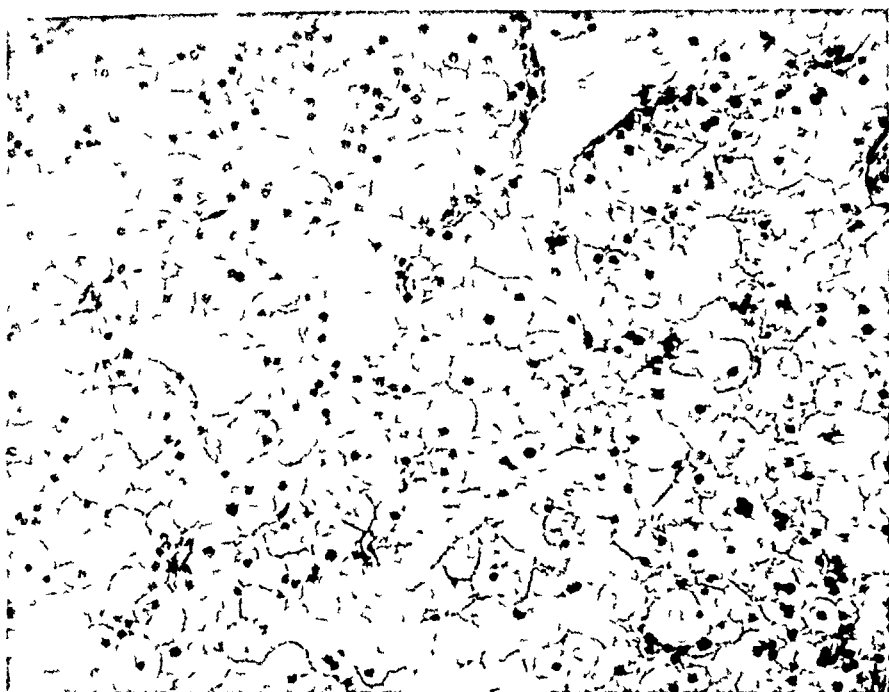


Fig 1 Case 2 Enlarged parathyroid gland removed in 1930 Diffuse hyperplasia



Fig 2 Case 2 Enlarged parathyroid gland demonstrated by post-mortem examination in 1942 Nodular hyperplasia



Fig 3 Case 11 Solitary adenoma



Fig 4 Case 10 Nodular hyperplasia

A brief description of the histological pictures of the examined parathyroid glands reveals the following facts

*Case 1* Gland, the size of a hazel-nut of homogeneous structure, no lobation The tissue composed of enlarged chief cells with a weakly staining, slightly granular protoplasm and large hyperchromatic nuclei in the centre of the cells The tissue of pseudoglandular structure with follicles containing a small amount of thin secrete Recent hemorrhages in the periphery of the gland The gland bounded externally by a thick capsule consisting of connective tissue and in some places containing an abundance of calcium deposits In one place outside this capsule an island of glandular tissue split apart by coarse streaks of connective tissue The cells in this tissue smaller than in the gland itself, but of the same type The tissue shows small foci of still smaller cells, poor in protoplasm and presenting round hyperchromatic nuclei Occasional spaces after fat cells

*Case 2* Gland removed in 1930, a little larger than a walnut, presenting lobation The tissue composed of large, vesicular water-clear cells The size of the cells in the different lobes slightly varying Several lakes of secrete One, the size of a hazel nut, contained cholesterol crystals

*Autopsy in 1912* reveals two glands about the size of a walnut both presenting a distinctly lobated or nodular structure The different nodules more or less sharply separated by coarse streaks of hyalinized connective tissue, calcified in some places Most of the nodules composed of large, water-clear cells Occasional smaller nodules consisting of chief cells Nodules containing both types of cells also observed Occasional small groups of oxyphilic cells Cystic spaces filled with colloid or blood in several places

*Case 3* Gland, a little larger than a walnut, diffuse enlargement, no lobation The tissue composed of slightly enlarged chief cells with a hyperchromatic nucleus in the centre of the cell and a weakly staining vesicular protoplasm Many capillaries In the periphery of the gland a cord of glandular tissue split up by strands of connective tissue with numerous capillaries causing poor delimitation between this and the rest of the tissue Remains of the original gland observed

*Case 4* Gland, barely the size of an almond slightly lobated or presenting a nodular structure The different lobes, however, not sharply separated by connective tissue The larger lobes consisting of cells of the chief cell type, but smaller than the normal chief cells In some places alveoli filled with secrete Strands or bands of cells with a smaller cytoplasm and round, hyperchromatic nuclei also observed These strands showing occasional small, empty alveoli, scattered about or clustered together *In the periphery of the gland a narrow band of apparently normal parathyroid tissue containing fat cells*

*Case 5* One gland the size of a large pea and another the size of a bean Both of the same structure, no lobation. The tissue composed

mainly of water-clear cells in pseudoglandular arrangement. In some places alveoli filled with secrete. No remains of normal tissue.

*Case 6* Gland the size of a pigeon's egg, with a suggestion of lobation. The tissue, however, comprised mainly of large water-clear cells in pseudoglandular arrangement. The nucleus generally situated at the base of the cell, but also met with in the centre. Occasional large spaces filled with secrete. The secrete showing occasional spaces after discharged, cholesterol-like crystals. The tissue hyperemic and presenting hemorrhages. Numerous fat cells in the periphery of the gland.

*Case 7* Gland, slightly larger than a hazel-nut presenting no lobation. The tissue mainly composed of large water-clear cells in pseudoglandular arrangement. In some places alveoli filled with secrete. Large recent hemorrhages.

*Case 8 Right* The sections show two lobes. The one composed of large water-clear cells, the other of slightly smaller chief cells with the nuclei situated at the base of the cells. Scattered small alveoli filled with secrete. Intense hyperemia and recent haemorrhages.

*Left* Gland, large and lobated, mainly consisting of water-clear cells with the nuclei situated at the base of the cell. Regions presenting large cells of similar structure with the nuclei in the centre of the cells also observed. Large hyalinized areas in the tissue. Fat and an abundance of calcium in the capsule.

*Case 9* Gland, the size of a hazel-nut, presenting a slightly nodular structure. Large regions consisting of small chief cells arranged in alveolar groups or strands. Occasional small spaces resembling follicles, mainly filled with a thin secrete. In some regions more numerous and larger spaces of the same kind.

Other regions consisting of slightly larger chief cells with a weakly staining protoplasm. A number of small regions composed of large water-clear cells. The nuclei sometimes situated in the centre of these cells sometimes at the base. The different tissue regions not distinctly separated from each other by connective tissue. *Between this nodular gland and the thyroid a triangular island of apparently normal parathyroid tissue with lacunae after fat cells.*

*Case 10* Gland nearly plum-sized, presenting a nodular structure. A number of the lobules consisting of large chief cells with a weakly staining, vesicular protoplasm. Others composed of small, somewhat atypical chief cells presenting no pronounced alveolar arrangement. Large and small irregular spaces filled with a secrete or blood observed everywhere. One region in the periphery of the gland showing a narrow group of very small atypical chief cells with no distinct alveolar arrangement. In the connective tissue capsule a small island of essentially normal, adult parathyroid tissue.

*Case 11* Gland, about the size of a hazel-nut, no lobation. The cells smaller than the ordinary chief cells presenting small, hyperchromatic nuclei in the centre of the cells. In some regions the cells presenting a

more abundant, weakly staining protoplasm The cells arranged in alveolar groups Scattered small spaces, filled with secrete or empty No fat The tissue intensely hyperemic No remains of adult glandular tissue

*Case 12* Gland, approximately plum-sized presenting a slightly nodular structure The tissue mainly consisting of small cells in alveolar groups separated by coarse or fine strands of connective tissue This connective tissue showing a diffuse round cell infiltration, especially towards the periphery of the gland A number of coarse connective tissue bars dividing the gland into lobes In the glandular tissue several spaces filled with secrete some of which reaching the size of a hazel nut The secrete showing lacunae after discharged cholesterol-like crystals The tissue in the periphery of the gland presenting a more normal structure although containing smaller cells and more connective tissue than is ordinarily the case The tissue to a great extent divided up by fatty tissue The regions so formed not distinctly separated from the rest of the gland by connective tissue In one place a small elongated and flattened region of atrophic parathyroid tissue sharply delimited from the rest of the gland by coarse, hyalinized connective tissue

The size of the examined glands varied between that of a broad-bean and a hen's egg No definite relation could be established between the degree of the glandular enlargement and the duration of the hyperparathyroidism

The examined glands 2, 1 and 1 respectively showed in 3 cases 5, 6 and 7 a homogeneous enlargement mainly composed of large water-clear cells

In cases 1, 3 and 11 the tissue in the examined glands (only one in each case) was also fairly homogeneous, but the size, type and arrangement of the cells were so abnormal that we feel justified to speak about solitary adenomas This conception is also supported by the fact that in cases 1 and 3 remains of adult glandular tissue could be seen besides the adenoma

The glands showed a more or less distinct nodular character in five cases (4, 8, 9, 10 and 12) which presented adenomas of varying size and histologic appearance In four of these cases (4, 9, 10 and 12), remains of adult glandular tissue were met with In one case (12), however, this tissue was abnormal containing water-clear cells or small adenomas

Case 2 is a border line case as both glands removed at the operation only present the slightest lobation and mainly consist of large water-clear cells throughout, whereas the two enlarged parathyroid glands, demonstrated at the autopsy 12 years after the operation, were distinctly nodular, containing nodules of dif-



ferent kinds of cells With the exception of the last mentioned case it will, consequently, be possible to distinguish between the following 3 types of parathyroid enlargement

- 1 A diffuse enlargement of one or more glands, the tissue consisting of large water-clear cells

- 2 Solitary adenoma

- 3 Nodular enlargement of one or more glands with adenomatous nodules in a changed parenchyma

We are consequently met with a striking morphologic resemblance to the different kinds of goitre in thyrotoxicosis

A comparison between the histologic nature of the glands and the clinical picture presents the following features

Two characteristic differences distinguish the 3 cases belonging to group I from the other cases The blood calcium did not return to a normal level after the operation and in two cases the blood calcium remained distinctly increased

X-ray examination showed no osseous lesions in any of these 3 cases, while in the other cases such lesions were present In this respect they correspond closely to the 5 cases which CASTLEMAN & MALLORY in their well known study of the parathyroids in hyperparathyroidism referred to the group »hyperplasia» and which is characterized by a diffuse enlargement of all the glands consisting of large water-clear cells BERGSTRAND has, however, demonstrated that lesions of the *ostitis fibrosa generalisata* type may be observed histologically even in the cases in which no changes are demonstrated by X-ray examinations of the skeleton The significance of the negative X-ray examinations in our cases is consequently quite uncertain

The cases belonging to groups 2 and 3 showed no essential clinical differences, either as regards the symptoms or as regards the course of the disease

Consequently, the pathologic examination of our material does not prove any relationship between the different histologic structure of the glands and the different clinical picture, although this is indicated by certain observations

The question remains open whether the pathologic examination of the glands permit any conclusions about the pathogenesis of the hyperparathyroidism As previously mentioned this has been the subject of much discussion

The crux of the problem may be set out as follows

The essential problem is if the hyperparathyroidism is produ-

ced by a neoplastic disease sui generis in the parathyroids, or if the parathyroid enlargement and hyperfunction is a consequence of another disease, i. e. a kidney disease, a D-hypovitaminosis or to a general hormonal disorder. The problem has already been discussed in the light of the clinical observations in our material.

No definite conclusion was drawn in support of the theory that the enlargement of the parathyroids should be secondary to a kidney lesion or connected with a general endocrine disorder.

In order to tackle this problem from a pathological point of view, a well examined autopsy material, preferably of early cases, must be available. All the parathyroid glands must be carefully examined and so must all the other endocrine glands, especially the hypophysis.

Our material is, as previously mentioned, too insufficient in this respect to allow any decisive judgment as regards the pathogenesis of the hyperparathyroidism. The following facts must however be emphasized, all the parathyroid glands should be about equally affected or enlarged if the parathyroid enlargement and overactivity be secondary to one or another disease. PAPPENHEIMER & WILENS have demonstrated a diffuse enlargement of the parathyroids in 53 out of 56 cases of nephritis, in 3 cases an adenoma was present. BERGSTRAND has described a case of "renal dwarfism" in which all the parathyroid glands were enlarged, although showing a nodular structure. Only the enlarged glands removed at the operation were, as previously mentioned, studied histologically in most of our cases, whereas the other parathyroid glands were exposed at the operation and found to be macroscopically normal. These facts indicate that in our cases the parathyroid enlargement was not a secondary phenomenon. The possibility cannot be excluded, however, that the glands may be affected asymmetrically in secondary parathyroid diseases, only one or two glands becoming enlarged and changed, while the others remain relatively unaffected. This is indicated by case 2, after the removal of only one enlarged parathyroid gland at the first operation, a few months later another parathyroid gland was removed.

The other glands were found to be of normal size at these operations, they were, however, greatly enlarged at the autopsy 12 years later, showing a nodular structure. 3 of our cases, 6, 7 and 8, in which the removed glands showed a diffuse enlarge-

ment, may develop in the same manner, This is of the greatest importance as regards the prognosis after a parathyroidectomy

On account of the insufficiency of our material we have to summarize by saying that our pathological examinations do not allow any conclusions regarding the nature and the pathogenesis of the parathyroid enlargement

### Summary.

The material comprises 12 cases of hyperparathyroidism, all female Bone changes of the *ostitis fibrosa generalisata* type occurred in 8 cases and a diffuse *ostoporosis* in one case Bone lesions visible at the X-ray examination were not present in 3 cases Calcifications or real concretions in the kidneys were met with in 8 cases, albuminuria in 10 and infection in the urinary passages in 9

The authors pay special attention to the kidney lesions associated with hyperparathyroidism distinguishing between non-inflammatory parenchymal injuries, infections inflammatory changes and concretion formation with its consequences Tests of kidney function seem in some of the cases to support the opinion expressed by other authors that the tubular lesion is the primary factor in the hyperparathyroidism

As regards the pathogenesis, the authors concluded that the kidney lesions were probably produced by, and not the cause of the hyperparathyroidism Nor does the material indicate that endocrine disorders have anything to do with the development of the hyperparathyroidism

Special attention has been given to the prognosis after parathyroidectomy, which operation was performed in 11 cases Only one gland was removed in 7 of the cases and in 4 cases two glands It was emphasized that the condition of the kidneys may be the most important factor for the prognosis, as the kidney damage may progress and lead to death in uremia, even when the other symptoms of hyperparathyroidism disappear It was shown, however that the renal function may sometimes improve after a parathyroidectomy Another important factor for the prognosis is whether the hyperparathyroidism has been definitely cured by the parathyroidectomy All the hyperfunctioning parathyroid glands must be removed and the cases carefully followed

up, as normally appearing glands left at operation may become hyperplastic and hyperfunctioning later on

Pathologically, it was possible to distinguish between three kinds of parathyroid enlargement in the present material, viz, diffuse enlargement, solitary adenoma and nodular enlargement. No specific connection could be demonstrated between these histologic types and differences in the clinical pictures. It is a remarkable fact, however, that no bone lesions visible at the X-ray examination were present in the three cases of diffuse parathyroid enlargement, neither did the blood calcium drop to a normal level after the parathyroidectomy. The pathologic study does not permit any definite conclusion regarding the nature and the pathogenesis of the parathyroid enlargement, at any rate, it does not indicate, that the enlargement is a secondary phenomenon

### Zusammenfassung.

Das Material umfasst 12 Fälle von Hyperparathyreoidismus, sämtliche Frauen. Skelettveränderungen vom Typus der Ostitis fibrosa generalisata kamen in 8 Fällen vor, diffuse Osteoporose in 1 Falle, während in 3 Fällen röntgenologisch sichtbare Skelettveränderungen fehlten. Kalkherde oder echte Konkreme in den Nieren wurden in 8 Fällen gefunden, Albuminurie in 10 Fällen und Harnwegsinfektion in 9

Verff halten sich besonders bei den in Verbindung mit Hyperparathyreoidismus auftretenden Nierenschädigungen auf, und teilen diese in nicht-entzündliche Parenchymschaden, infektiös-entzündliche Veränderungen sowie Konkrementbildung und deren Folgezustände. Die Nierenfunktionsproben in einigen der Fälle scheinen für die von anderer Seite aufgeworfene Auffassung zu sprechen, dass die Tubulischädigung beim Hyperparathyreoidismus das Primäre darstellt

Inbezug auf die Pathogenese kommen Verff zu dem Schluss, dass die Nierenschädigungen wahrscheinlich Folge und nicht Ursache des Hyperparathyreoidismus gewesen sind. Auch spricht das Material nicht dafür, dass endokrine Störungen für die Entstehung des Hyperparathyreoidismus eine Rolle gespielt hatten

Besonderes Interesse wurde der Prognose nach der in 11 Fällen vorgenommenen Parathyroidektomie zugewandt. In 7 dieser Fälle wurde nur eine Drüse entfernt, in 4 Fällen 2 Drüsen. Es

wird betont, dass der Zustand der Nieren für die Prognose vielleicht die grösste Bedeutung besitzt, da die Nierenschädigung selbst wenn die anderen Symptome des Hyperparathyreoidismus verschwinden, weiterschreiten und den Tod an Uämie herbeiführen kann. Jedoch wird nachgewiesen, dass in gewissen Fällen nach Parathyreoidektomie eine Besserung der Nierenfunktion eintreten kann. Für die Prognose massgebend ist ferner, ob es durch die Parathyreoidektomie gelungen ist, den Hyperparathyreoidismus endgültig zu beheben. Es müssen deshalb sämtliche hyperfunktionierenden Nebenschilddrüsen entfernt werden, und die Fälle sorgfältig verfolgt werden, da bei der Operation zurückgelassene, anscheinend normale Drüsen später Hyperplasie und Hyperfunktion aufweisen können.

Pathologisch-anatomisch lassen sich in unserem Material folgende drei Formen von Parathyreoideavergrösserung unterscheiden: Diffuse Vergrösserung, solitares Adenom und nodöse Vergrösserung. Diesen histologischen Unterschieden der Nebenschilddrüse entsprechen jedoch nicht mit Sicherheit Verschiedenheiten im klinischen Bilde, doch ist es immerhin bemerkenswert, dass bei den 3 Fällen von diffuser Nebenschilddrüsenvergrösserung röntgenologisch nachweisbare Knochenveränderungen fehlten, und der Blutkalk nach Parathyreoidektomie nicht auf normale Werte sank. Die pathologisch-anatomische Untersuchung lässt keine sicheren Schlussfolgerungen in bezug auf die Natur und Pathogenese der Parathyreoideavergrösserung zu, spricht aber wenigstens nicht dafür, dass die Nebenschilddrüsenvergrösserung sekundär sein sollte.

### Résumé.

Le matériel comprend 12 cas d'hyperparathyroïdisme, tous féminins. Des altérations squelettiques du type de l'ostéïte fibreuse généralisée existaient dans 8 cas, une ostéoporose diffuse dans 1 cas et dans trois cas il n'y avait point de modifications osseuses radiologiquement constatables. Des calcifications ou de véritables calculs au niveau des reins furent trouvés chez 8 malades, de l'albuminurie chez 10 et une infection des voies urinaires chez 9.

Les auteurs s'attachent particulièrement aux lésions rénales associées à l'hyperparathyroïdisme et les subdivisent en lésions non inflammatoires du parenchyme, lésions inflammatoires infectieuses, et lithiase avec ses suites.

Les épreuves rénales fonctionnelles pratiquées dans quelques-uns des cas semblent parler en faveur de la conception, défendue par d'autres auteurs, selon laquelle la lésion des tubuli serait la lésion primitive dans l'hyperparathyroïdisme.

En ce qui concerne la pathogénie, les auteurs arrivent à la conclusion que les lésions rénales étaient vraisemblablement la conséquence, et non l'une des causes, de l'hyperparathyroïdisme.

L'étude du matériel ne fait pas penser non plus que des troubles endocriniens auraient pu jouer un rôle dans l'apparition de l'hyperparathyroïdisme.

Les auteurs se sont particulièrement intéressés à la question du pronostic de la parathyroïdectomie, qui fut exécutée dans 11 cas. Dans 7 de ceux-ci on n'enleva qu'une glande et dans 4 on en supprima 2. Ils soulignent que c'est peut-être l'état des reins qui a la plus grande importance pour le pronostic, attendu que, même lorsque les autres symptômes d'hyperparathyroïdisme sont susceptibles de disparaître, la lésion rénale peut continuer à évoluer et aboutir à la mort par urémie. Cependant il est indéniable que dans certains cas une amélioration de la fonction des reins peut survenir après la parathyroïdectomie. Ce qui, de plus, joue un rôle décisif pour le pronostic, c'est de réussir à supprimer définitivement l'hyperparathyroïdisme par la parathyroïdectomie. Aussi faut-il enlever toutes les glandes parathyroïdes qui sont en état d'hyperfonctionnement et suivre exactement les cas, attendu que des glandes d'aspect normal, laissées en place lors de l'opération, peuvent plus tard présenter de l'hyperplasie et un fonctionnement exagéré.

Au point de vue anatomo-pathologique on peut, dans notre matériel, distinguer les trois formes suivantes d'hypertrophie des parathyroïdes : l'hypertrophie diffuse, l'adénome solitaire, et l'hypertrophie nodulaire.

On ne saurait, à vrai dire, affirmer avec certitude qu'il existe une corrélation entre ces variétés histologiques des parathyroïdes et le tableau clinique, mais il faut pourtant mentionner que dans les trois cas d'hypertrophie diffuse, des altérations osseuses reconnaissables radiologiquement faisaient défaut, et que la calcémie ne redescendit pas jusqu'aux chiffres normaux après la parathyroïdectomie. L'examen anatomo-pathologique ne permet de tirer aucune conclusion sûre concernant la nature et la pathogénie de l'hypertrophie des parathyroïdes, mais ne milite du moins pas en faveur de l'hypothèse que cette hypertrophie serait secondaire.

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